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## Fumigating Foreign Cotton to Kill Our Imported Pests

IT seems rather paradoxical that a cotton-producing country like the United States should be importing approximately 22,000,000 pounds of cotton through the Port of New York, and about five times that much through the Port of Boston, each year; yet such is an established fact. Large quantities of this staple are imported annually from China, Egypt, Haiti, India, Mexico and Peru, as well as from the Territory of Hawaii. These foreign cottons are imported chiefly because they possess certain characteristics that are lacking, or are not so well developed, in domestic cottons; and these peculiarities make them better adapted for some special purposes than home-grown cottons.

Incidentally, cotton is not the only article imported with each bale of cotton, for hidden away in the bolls there are numerous insect pests known as the pink boll worm. Already the ravages of our domestic cotton boll weevils are only too well known; for these insects annually cause a loss of more than $50,000,000 to the cotton crop of the United States, to which must be added the large sums expended in attempts to check its destructive work. The foreign pink boll worm, too, ravages the cotton crops in its native lands; so, because of its evil reputation, the United States is none too eager to allow it to enter and gain a foothold here.

The pink boll worm was found in India a number of years ago, probably originating there, and more recently in Burma, Ceylon, Egypt, British East Africa, German East Africa, Nigeria, Sierra Leone, Straits Settlements, and the Hawaiian Islands, with a doubtful record of its occurrence in Japan, according to Harry B. Shaw, Pathological Inspector of the Federal Horticultural Board.

The seriousness of the menace to the domestic cotton crop through the work of the pink boll worm, should it become distributed in this country, was early realized by the Department of Agriculture, and especially since the effects of its ravages have already become apparent in the Territory of Hawaii. Expedients were therefore planned some time since by the Federal Horticultural Board to prevent the entrance of the pest into the United States, the best measure found thus far being that of killing the worms by poison gases.

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**Fumigation plant for the treatment of foreign cotton entering the Port of New York**

*In the oval:* Unloading the bales of cotton from the fumigator car, after treatment. *At the left:* Bales of foreign cotton emerging from the fumigating chamber after one hour and forty-five minutes' treatment with hydrocyanic-acid gas. Note the gas mask worn by the operator as a protection against the poisonous fumes. *At the right:* One entrance to the fumigating chamber, showing the huge gate and the track, as well as a car emerging from the chamber.

The rules and regulations governing the importation of cotton into the United States condition the entry of such cotton upon disinfection under the supervision of an inspector of the Department of Agriculture, and it is for just such a purpose that a cotton-treating plant has recently been installed at Bush Terminal, New York Harbor. This plant, like the others already in use at Boston, Mass., and San Francisco, Cal., represents the practical application of the experiments of Mr. E. R. Sasscer, Chief Inspector, Federal Horticultural Board, and Dr. Lon E. Hawkins, Plant Physiologist, Department of Agriculture.

Unmanufactured cotton and cotton waste from abroad, according to the Federal rules and regulations, must be disinfected in a suitable fumigation chamber by fumigation with hydrocyanic-acid gas, generated by combining cyanide with diluted sulphuric acid. The only cyanide available for fumigation purposes at the present time is sodium cyanide, and this grade must be guaranteed to contain not less than 51 per cent cyanogen. The sulphuric acid employed must be commercial sulphuric acid, 66 degrees Baume, which is approximately 99 per cent pure.

The cotton fumigation equipment at the Bush Terminal consists of a large fumigating chamber, built of stout steel and provided with electrically-operated gas-tight-fitting doors at either end; a gas generator, and an electrically-driven vacuum pump. Tracks lead from platforms at either end of the fumigating chamber, right into the chamber; and two long cars are placed on these tracks for the handling of the cotton bales. In practice, one car, loaded with cotton, is pushed into the tank and left under treatment for the prescribed one hour and forty-five minutes, after which the other car, which has meanwhile been loaded, is pushed into the fumigating chamber from the other side. In this manner the equipment is never idle awaiting the loading and unloading of the cars.

After the cotton in its packed form has been placed on one of the flat cars and wheeled into the chamber, the two short lengths of connecting rails are removed and the huge steel door is electrically lowered into place, so as to seal the chamber. The air is now exhausted until the gage registers 25 inches. At this stage the gas is generated by introducing into the generator the chemicals previously mentioned, in the following order: Water, acid and cyanide in solution. The valve separating the generator and fumigation chamber is then opened either before, or as soon as, the cyanide solution begins to flow into the generator. The cyanide solution is then run in at such a rate that it will require from 8 to 10 minutes for all of the solution to be introduced. At the expiration of 15 minutes air is permitted to pass through the generator for five minutes, to wash out all of the gas in the generator, and then the valve separating the fumigation chamber from the generator is closed. At this stage the air valve on the fumigation chamber is opened and the air allowed to rush in until the gage on the fumigation chamber falls to five inches; the bales are held in the presence of the gas and air for one hour and twenty-five minutes additional completing the required exposure of one hour and forty-five minutes.

At the completion of the exposure, to remove the mixture of gas and air from the cotton, the fumigation chamber is pumped to a vacuum of 25 inches, and on reaching this vacuum the valves of the chamber are opened. As the air enters, the pump is kept running a sufficient length of time to remove an amount of air twice the volume of the chamber. The pump is then temporarily stopped, until the doors are opened, and again started and kept running while the fumigated bales are being removed.

After the desired end gate has been raised, the workmen replace the two short lengths of connecting rail, and the flat car is rolled out. Meanwhile the gate at the other end is raised and the other flat car, loaded with a new lot of cotton, is wheeled into the chamber. The men, particularly the one who lays the connecting rails in place, usually wear respirators which contain a sponge moistened with a one per cent solution of sodium hydroxide, as a protection against the poisonous hydrocyanic-acid gas. Other precautions, such as blowers, are resorted to, and certain antidotes are always at hand.

## Fresh Evidence of Perils of Paper Money

BECAUSE of the scarcity of silver money due to the war most of the French Chambers of Commerce have issued bank notes ranging in value from 2 francs to 2 sous. The remarkably filthy condition these soon acquire caused the authorities of Rouen to ask the Director of the Municipal Laboratory of the city to make analysis of the foreign matter incrusted upon these small bills. The results of this well-known chemist's comparative analysis of new bills and used bills is startling. *Je Sais Tout* (Paris) reports that after a circulation of only eight or ten days 100 grams of this paper money had collected no less than 20 per cent of its own weight of dirt. Analysis showed that this was compounded of fatty matters, ammonical and nitrogenous substances, sugars and mineral products. Worse still, this greasy coating was found to contain the most virulent germs of disease, as was made evident by examining with the ultramicroscope the liquid obtained by macerating the dirty bills in distilled and sterilized water.

## Fire-Protection Studies at the Bureau of Standards

THE last annual report of the Bureau of Standards outlines the work which the Bureau hopes to undertake as its appropriate contribution to the nation-wide campaign against fire, provided Congress grants a modest increase in its appropriations. Apart from thousands of lives destroyed by fire, this country sustains an annual loss from this cause of at least $300,000,000; a per capita loss nearly ten times as great as that found in the leading countries of Europe.

In the great public movement to reduce this loss, led by the National Fire Protective Association, the Bureau of Standards can be most usefully employed in the determination of fundamental engineering data, to serve as a basis for the revision of state and municipal building codes.

It is proposed to continue the fire tests already begun on structural steel building columns, fireproofed in different ways, and of reinforced concrete columns of different aggregates and types of construction. Tests of floors, roofs, fire-resisting doors, shutters, windows, etc., must eventually be included in the program if American engineers are to be supplied with the data necessary for redrafting the present unsatisfactory building codes. The Bureau hopes to secure, among other things, a fire hut, about 50 x 25 feet, and one story high, for special experiments on the standardization of fire tests. This would provide means for observing the temperatures attained in characteristic types of fires in such a structure, when furnished, for example, as an office, a furniture storage warehouse, a unit of a department store, etc. The cost of building and equipping such a structure would be seven or eight thousand dollars.

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*The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.*

*The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.*

## From the North Sea to the Atlantic

THE transference of the German submarine flotillas from the comparatively shallow waters of the North Sea and the English Channel out to the deep waters of the Atlantic, has rendered German submarine warfare increasingly perilous to the shipping of the Allied and neutral powers. Also, it is certain that the later German submarines, which are creating such havoc among merchant shipping, are larger and more formidable craft than those against which the defensive measures of the Allies have proved so effective during the past 18 months.

There was a certain physical condition pertaining to submarine operations in the Channel and the North Sea which greatly favored the defense, so long as operations were confined to those circumscribed areas. We refer to the comparatively shallow depth and to the fact that the bottom is generally light in color; a combination which rendered it possible for an aeroplane observer to detect, even at considerable depth, the grayish, shadowy, cigar-like form of a submarine, whether it was moving, or asleep upon the bottom. The shallowness of these waters also was favorable to the use of nets, a form of defense, and of offense for that matter, which has probably accounted for more boats of the enemy than any other of the means employed.

The absolute immunity of the vast fleet of transports, which forms the only line of communication between the British Army in France and the British Isles, has undoubtedly been due to the free use of heavy nets, whose integrity has been safeguarded by a powerful patrol fleet. Also, after the location of a submarine from the air, the trawlers have cast these nets about the victim, in much the same way as the East coast fisherman is wont to cast a seine net about a school of mackerel. This much as been learned from sources of such authority as to leave little doubt as to its truth.

But with the removal of the field of attack out into the deep waters of the Bay of Biscay and off the coast of the British Isles, many of the advantages of the defense have been lost, and there can be no doubt that the problem has been greatly complicated. The area of the field of operations has been so greatly enlarged and the depth of water is so great as to prohibit the use of nets with anything like the successful results achieved in the North Sea and the Channel. Once the large German U-boats have escaped from their bases, fully replenished as to oil, provisions, torpedoes and ammunition, and have reached the Atlantic approaches to the Allied coasts, they are practically immune to every form of attack except gun-fire. The sweep of their operations is too vast to be covered effectively by aeroplane observation; only where traffic converges at the approaches to the Allied ports can these be used in sufficient numbers adequately to cover the field.

Under existing conditions, the rapid-fire gun, then, would seem to be the most effective weapon; and the answer to the present German methods, so far as the U-boats that go out into deep water are concerned, is to cover the seas with numerous flotillas of fast, able, seagoing submarine chasers, armed preferably with the 3-inch 14-pounder gun, and the arming of all merchant ships with guns of not less than 3-inch, and preferably, if they can be secured in sufficient numbers, with guns of 4-, 4.7- and 6-inch caliber.

If we are to go to war with Germany, it will be over this U-boat campaign; and there is no way in which we could strike with such telling effect as by building a vast fleet of big, fast, seagoing motor boats, and dispatching them to coöperate with the Allied fleets against the common enemy. And these boats should be designed specifically for deep-sea service; they should be big, fast and, like the new German submarines, capable of remaining at sea for lengthy periods of service. Their minimum length should be 100 feet; their maximum speed, 30 knots; and they should mount on the fore deck a gun of not less than 3-inch caliber.

Now we are well situated for the rapid construction of a large fleet of such boats; for their hulls could be built at the yacht building yards, big and little, of which we have some hundreds scattered along our Atlantic and Pacific coasts, the Great Lakes, and on our large rivers. Any yacht builder capable of turning out a 30-foot knockabout or a 50-foot motor boat, could be trusted, under expert government supervision, with the task of building the hull of a 100-foot submarine chaser.

The construction of the engines would be the more serious task; but we believe that we have a sufficient number of builders of experience whose output, if they were working to full capacity on a standardized type, would go far to meet an urgent demand for the motors for a thousand boats.

And back of the existing builders of motor-boat engines is the great array of high-class engineering firms which could adjust themselves to oil-engine work with but little delay. So great is our capacity, that it would be possible to complete a thousand boats in two months, and double that number in three months' time.

But is the situation so urgent? We do not hesitate to state our belief that it is. The SCIENTIFIC AMERICAN has long been convinced that practically the whole of Germany's great shipbuilding facilities were being devoted to submarine work, and that, long ago, she ceased work on capital ships. A correspondent who recently steamed down the Elbe at Hamburg tells us that the building ways were crowded with vessels—all of small size—submarines or destroyers, he could not tell which. Germany must have realized, long ago, that her one remaining chance to strike a *vital* blow lay in the indiscriminate sinking of merchant ships—even though it involved a break with the United States, whose policy during the past thirty months has doubtless led Germany to believe that, even in the event of a break, we would take no active part in the European war.

Is Germany right in this belief? Is a policy of watchful waiting to be followed by a policy of watchful warring?

Germany has sunk nearly five hundred thousand tons of shipping in the first thirty days of this campaign. Not even the British fleet can stand that scale of loss; and we must remember that Germany's submarine fleet is being increased as fast as her magnificent shipyard and machine shop facilities can turn the boats out. The losses of submarines are much smaller in deep water than they were in the North Sea and the Channel. We do not look for any decrease in the monthly losses of Allied and neutral ships.

Starvation will bring any country to its knees and if a "victory" peace were won by Germany, we may be certain that one of the cardinal conditions would be a free hand for Germany in this Western Hemisphere.

And with the British fleet out of the way, how long would it be before Germany (whose dreadnought fleet *in commission* is twice as strong as our own) would set sail to collect the cost of the war from that country, which she believes, or affects to believe, robbed her of victory in the first year of the war?

## The Submarine as a Mother Ship for Seaplanes

OFTEN and loudly has it been proclaimed of late that, in the event of war between Germany and ourselves, our coastal cities will be seriously threatened by hostile aerial fleets. But in no instance is the manner in which hostile aircraft might reach our shores, explained. And when one remembers that some three thousand miles of water and the entrenched lines and the alert fleets of friendly nations stand between us and the aerial threat, the vision of American cities attacked from the air pales into insignificance.

Yet such a danger does exist, provided the enemy be sufficiently resourceful; and in the case of Germany we have been taught full well by the past thirty months of war that she seldom overlooks an opportunity of harassing her enemies with every means known to modern science. No doubt—and we have been told so in as many words by the leading German writers—Germany has long since discounted our possible entrance into the world war; so the suggestion that follows has no doubt been considered by the Teutons. At any rate, we are not offering a new idea to them, for surely the same thought has already occurred to their higher command.

There is only one way in which German aircraft can reach our shores, and that is by being carried across the ocean on boats to within a short distance of the field of operations. In other words, a mother ship must be resorted to, not only to carry the aircraft across the three thousand odd miles of water, but to serve as a base for the airships. Immediately the thought of a conventional mother ship suggests itself—a tramp-steamer sort of a looking craft, which, like so many other German raiders, might succeed in slipping through the cordon of the British fleet. But then again this would hardly be practical, for once the mother ship reached our shores it would soon be detected and run down by our naval units, even before the aircraft could inflict any serious damage on their intended prey.

Obviously, then, the mother ship in this instance must be one that can hide when necessary; and now the submarine suggests itself. Supposing a submarine of the cargo-carrying type, similar to or even larger than the "Deutschland," were employed for the purpose: obviously, it could not be used for airships of the magnitude of Zeppelins, but quite conceivably it might be employed to carry several seaplanes. These craft, with their wings and framework dismantled, can be packed into a small space, and a large cargo-carrying submarine might very easily carry say four or six of them, aside from an ample supply of fuel, lubricating oil, bombs, and spare engines and parts. If seaplanes of the type employed in the British navy, with folding wings to facilitate handling and storage, were employed, the underwater mother ship could readily submerge within a few minutes with its brood of mechanical birds, completely baffling all attempts on the part of naval scouts to locate the base of the aircraft.

Of course, this is purely a suggestion, and most likely as not the "game would not be worth the candle." For the expense and trouble involved in carrying out such an enterprise would not be worth the comparatively slight damage that might be inflicted on our coastal cities and military works; yet, on the other hand, and judging from past performances, the moral value of such a raid might be considered well worth while by our attackers. There are perhaps certain mechanical difficulties in the way of carrying out this plan; although it is perfectly feasible in the light of present-day attainments in submarine navigation and aerial engineering—at least to an ambitious belligerent.

All of which sums up to just this much: There is a possibility of our being attacked from the air, and it would be a wise precaution indeed to give the matter some thought in any preparedness program.

## How Long Will Easter Eggs Keep?

IN the spring of 1916 the Prefect of Paris requested Léon Lindet, a member of the *Conseil d' Hygiene*, to investigate the question of how long hard-boiled eggs remain edible, and to report upon the question to the abovementioned body, the report to serve as a basis for legislation governing the sale of Easter eggs subsequent to the holiday. The result of his investigations, which were very extensive, were laid before the Council of Hygiene in October last. While much of the information gathered concerns chiefly dealers and Boards of Health, especially as regards the use of moldy or spotted eggs, there are certain conclusions of general interest.

It was found that the keeping qualities of raw eggs were much superior to those of cooked eggs, even though these retain their shell. This is of special interest to housewives, since, as a general thing, cooking helps to keep things edible, partly because of the sterilization by heat, partly perhaps because of chemical alterations due to the process of cooking. An interesting example is cited of the experience of some French soldiers held prisoners in Germany. Their families sought to add to their comfort by contributions of food, including eggs. But those prudent housewives who boiled the eggs before sending learned with dismay that they had arrived unfit to eat, while the eggs which had been sent raw remained fresh for weeks.

Mr. Lindet and his associates undertook to verify this teaching of experience by detailed scientific experiment, and their findings should be borne in mind at Eastertime particularly.

Of the number of new laid eggs chosen for this purpose half were left raw and the rest boiled for a quarter of an hour; they were then kept at a temperature of 28-30 degrees C. for fifty days, samples being taken out for testing at intervals, to determine the amount of ammonical nitrogen present, this being a measure of progressive deterioration. Eggs tested immediately after being laid have an average of 10 milligrams of ammonia per 100 grams of egg, with extreme variations of 6 and 14 milligrams. The percentage of ammonia in these eggs rose in fifty days from 10 milligrams to 26 milligrams for the raw eggs, and to 107 milligrams for the cooked eggs; that is, the deterioration. This increase was a minimum and in other experiments it was much augmented. "The investigation," says Mr. Lindet, "of the nitrogenated substance (matière azotée) gave us lower differences, ranging from 0.66 to 0.91 per cent for raw eggs, and to 1.36 per cent for cooked eggs."

He explains this greater alterability of cooked eggs by two facts: first, cooking makes the inner membrane pervious to gases, liquids, and microbes (this property being common to all organic membranes); second, the cooked white of the egg has ceased to be a viscous mass, but is composed of agglomerates of coagulated albumen between which are particles of a serum which is propitious to the evolution of microbes. This fact was proved by the analyses of the investigators; and while, both in new laid eggs and in raw eggs of different ages, the yellow contains more ammonia than the white; in cooked eggs it is in the white that the ammonia predominates, and this predominance increases in the same ratio as the age.

## Astronomy

**Martian Snow-caps and Sunspots.**—Since the preliminary announcement that he had found an apparent relation between the sunspot period and the behavior of the polar caps of Mars, M. Antoniadi has published detailed observations which appear to establish this relation in a striking manner. Except in two years, 1862 and 1877, when local conditions on Mars may have disturbed the effects of solar radiation, he finds that whenever sunspots are large and numerous the melting of the Martian polar caps is rapid, and that whenever sunspots are small and few the melting of the caps takes place slowly. As Maunder has pointed out, the meteorology of Mars is much simpler than that of the earth. Hence a more direct response on the part of Martian "weather" to the variations in solar radiation of which greater or less spottedness is one of the indications.

**The Nebula N. G. C. 2261.**—A spectrogram of Hubble's variable nebula N. G. C. 2261, which has as its nucleus the variable star R Monocerotis, shows the nucleus and the nebula to have the same peculiar spectrum consisting of bright lines or bands—not those typical of gaseous nebulae—and a continuous spectrum. This observation suggests that the nebula shines by reflected light of the pulsating nucleus, and that the flow of the light-pulses over the nebula causes its variation and could give its distance. From the material now available it is difficult to give any trustworthy value for the apparent displacement. It may be as great as fifteen seconds of arc. Taking this value and the simplest case of displacement perpendicular to the line of sight, which would give a maximum value for the distance and would generally overstate it, the parallax would be about 0.00027 or the distance some 12,000-light years.

**Barnard's "Runaway" Star, as we have generally called the star of remarkably great proper motion recently discovered in Ophiuchus—while other journals have referred to it under the rather meaningless name of "Barnard's proper-motion star"—is probably nearer to the solar system than any other fixed star whose parallax has been measured, with the exception of Alpha Centauri. The parallax observations at the Allegheny Observatory give a value of 0.5 second, while from micrometric measures made by Barnard, Russell obtains a value of 0.70 second. The parallax of Alpha Centauri is 0.76 second, corresponding to a distance of 4.3 light-years. According to determinations made by F. Gonnessiat, in France, from a comparison of photographs extending back to 1897, the new star is even nearer than Alpha Centauri. He finds its parallax to be approximately one second, representing a distance of only 3.26 light-years.**

**An Old Observation of Barnard's "Runaway" Star.**—Dr. A. C. D. Crommelin has pointed out the fact that the star recently discovered by Prof. Barnard to have a proper motion of more than ten seconds per annum was almost certainly observed by Lamont at Munich in July, 1842. The star was one of those enumerated in Lamont's "zones," and its designation is, accordingly, Munich (1) 15040. Prof. Bauschinger revised Lamont's zones at Munich about 1886, and in seeking for this star he naturally did not find it, as it had moved more than 7 minutes of arc from its former place. According to the spectroscopic observations of Professors Adams, Campbell and Slipher this interesting star is approaching us at a speed of something like 100 kilometers per second, and this should bring about a gradual increase in its proper motion; assuming the parallax found by Schlesinger, the proper motion would increase about .05 second a century.

**The Total Solar Eclipse of June 8, 1918.—An article on this forthcoming event, by Edison Pettit, of Washburn College Observatory, points out the fact that the eclipse will be a return of that of May 28, 1900, i.e., the intervening interval is the ancient eclipse cycle, or Saros, of 18 years 11⅓ days. Accordingly, while the 1900 eclipse occurred about 8 A.M., that of 1918 will occur about 4 P. M. (on an average for the whole country). The duration of totality is about the same in the two eclipses; viz., a minute and a half. The 1918 eclipse will begin when the moon's shadow strikes the earth on the little island of Borodino, off the coast of Japan, at sunrise, June 9, 1918. It will then sweep eastward, and after a lapse of two hours and fifteen minutes, will arrive at the mouth of the Columbia River, Wash., June 8, at 2.25 P. M., Pacific time, when it will be going at a speed of thirty-three miles a minute. It will cross the Mississippi River at 5.37, Central time, and leave the coast of Florida at 6.42, Eastern time. The diagonal journey across the United States will take forty-seven minutes. Mr. Pettit suggests that in case one of the eclipse parties in the western states should discover anything of novel interest, such as an apparent intra-mercurial planet, the fact could be telegraphed to other parties along the track of the eclipse in ample time to have the discovery checked by other observations. Some eighty-five towns, all accessible by rail, lie along the path of totality.**

## Science

**Testing Tuning Forks** is a new line of work, which the versatile United States Bureau of Standards has taken up. A tuning fork for use in ordnance tests has recently been standardized for the War Department, and equipment has been secured for carrying on such work regularly.

**Specifications for Lightning Conductors.**—Last year the Bureau of Standards issued a valuable bulletin on lightning protection, constituting a digest of the latest information on this subject. The bureau has since been conferring with the manufacturers of lightning-protection material and others and is preparing to issue specifications for protection systems, for the use of architects and builders.

**The "Black Siberian Hare."**—The Department of Agriculture has issued a warning on the subject of this animal, which certain dealers are trying to palm off on the guileless public. The situation recalls that of the "miracle wheats," concerning which the department recently enlightened the country. The "black Siberian hare" is advertised to produce a pelt of high market value. The fact is that, although more skins of hares or rabbits are collected and sold than of all other fur-bearing animals combined, no variety is worth raising for its fur alone. Moreover, Siberia does not produce hares, and the alleged new variety is merely a black strain of the "Flemish giant" breed of European hare.

**Woods Called "Mahogany."**—A bulletin just published by the Department of Agriculture on the subject of mahogany records, among other interesting facts, the bewildering ambiguity of the term "mahogany." True mahogany is produced only by two closely related species of tree, *Swietenia mahagoni Jacq.* and *Swietenia macrophylla* King, both natives of tropical America. The name "mahogany," with or without some qualifying word such as "Indian," "Madeira," "African," "Philippine," etc., is, however, applied to cabinet woods grown in a great many parts of the world. These so-called mahoganies belong to 67 distinct species, of 41 genera, and they are scattered through 18 families of the vegetable kingdom. Of some of the West African species the botanical status is unknown. To add to the confusion, true mahogany has many names and several more or less distinct varieties are recognized commercially.

**The National Gas-Safety Code.**—The last annual report of the Bureau of Standards tells of the progress that has been made in the preparation of a national Gas-Safety Code, which is intended to cover all phases of the production, distribution and utilization of gases with a view to eliminating dangers to life and health, and fire hazards. The code will consist of 10 parts, dealing with (1) manufacture, (2) distribution, (3) appliance design, (4) gas-fitting, (5) appliance installation, (6) natural-gas wells and field stations, (7) acetylene, (8) bottled-gas systems, (9) blast-furnace, producer and gasoline gas (10) utilization and information for users. The American Gas Institute has appointed 12 committees to collect information on different topics and in different sections of the country; while the National Commercial Gas Association, the Natural Gas Association of America, the National Fire Protection Association, the American Institute of Architects, the National Safety Council, and the National Association of Master Plumbers are all coöperating in the preparation of the code. Part 4, on gas-fitting, is in an advanced stage of preparation and will be published first, as the need for this part is most pressing.

**Electrolysis in Pipes and Cables.**—The damage done annually to underground pipes, cables and other metal structures in this country by electrolysis amounts to many millions of dollars. There are very few water, gas or lead cable systems that are not more or less subject at some points to electrolytic damage from stray currents. Moreover, the loss does not consist merely in the shortening of the life of such structures; electrolytic damage is one of the causes of the leakage of water and gas from distribution systems. The failure of such systems on account of electrolytic action may also involve various dangers to the life and health of human beings. According to the Bureau of Standards more than twenty-five separate and distinct methods of dealing with the electrolysis problem have been proposed and experimented with from time to time. Some of these methods are useless, or even harmful. The Bureau of Standards has been studying the subject of electrolysis mitigation for the past six years, and has aided in installing complete mitigative systems in several cities. The bureau makes somewhat detailed tests in each of these places about once a year to make sure that the protective systems are being properly maintained. An extended series of experiments has recently been undertaken in the city of Springfield, Mass., with the so-called three-wire system of electric railway operation; a system which offers considerable promise for the mitigation of electrolysis troubles under certain conditions frequently met with in cities.

## Electricity

**Flaming Arc Lamps for Illuminating Aviation Fields,** instead of petrol flares for this purpose, are advocated by Mr. Charles Bright, in the Final Report of the Committee on the Administration and Command of the Royal Flying Corps. It is pointed out that the flaming arc lamps are more readily controlled and give the best light for penetration of fog.

**Portable Electric Winches.**—Much time and labor are saved in a great variety of tasks by the use of electric winches at the Bush Terminal, in Brooklyn, N. Y. These winches are of the portable type and can be moved about as necessity dictates. Current can be tapped from the nearest feeder, a great number of taps being always within convenient reach in any part of the Bush Terminal development.

**Lehigh Valley May Electrify Part of Main Road.**—The Lehigh Valley Railroad is investigating the feasibility of electric operation of its main line, from Jersey City to Wilkes-Barre, about 176 miles, and the Mahanoy and Hazleton division, from Penn Haven Junction to Mount Carmel, about fifty-two miles, according to the *Electrical World*. It is planned to employ the generating plants of the Lehigh Coal & Navigation Company at Harwood and Hauto, with the installation of new power units and necessary transmission system. The improvement is estimated to cost about $11,000,000.

**Largest Motor Yet Built.**—What is said to be the largest electric motor yet built has recently been completed by a leading American electrical manufacturer, for use in driving a two-high 35-inch reversing blooming mill, which reverses for every pass; that is, every time metal goes through the rolls. Reversals can be made from full speed to full speed in about two seconds, and in regular work nineteen or twenty passes are made in two minutes. The motor has a rating of 15,000, and complete it weighs more than 250 tons. It is 20 feet high, and the shaft is over 2 feet in diameter.

**Early Electro-Mechanical Interlocking on Railroads.**—In the *Railway Gazette* there has been some discussion regarding the date at which electrically-operated shunting signals were first introduced on railroads. It has been stated that the first occasion on which such a system was used in the United States was at Gap, on the Pennsylvania Railroad, on December 30th, 1909. On the other hand, electrically-operated shunting signals were installed at Victoria Station (London) in a form similar in principle to that now generally used on railroads, as early as 1880. It appears, therefore, that in this matter the London, Chatham & Dover (now South Eastern & Chatham) Railway forestalled the United States by 30 years.

**The Use of Steel in Transmission Lines.**—In a recent paper read at a joint meeting of the American Institute of Electrical Engineers and the Association of Iron and Steel Engineers, Mr. H. B. Dwight emphasizes the utility of steel cables for transmission purposes on branch lines, especially in cases where the size of copper strictly required to meet the load would be too small for use in practice. For alternating currents the resistance of a steel cable is considerably greater than for direct current, owing to skin effect. In copper or aluminum conductors the latter is negligible, increasing the resistance by at most 1 or 2 per cent, but at high frequencies the apparent resistance of steel conductors may be increased by 100 per cent or more. The losses may be kept within moderate limits by using fine strands to act as laminations, and by winding the spirals of alternate layers of wire in reverse directions.

**American Electric Cars in Barcelona.**—The electric railroad running from Barcelona to Sarria, a distance of three miles, has recently been extended as far as Las Planas, about 3½ miles farther. The new section starts from the station of Sarria, passes through a tunnel 653 feet in length, follows the mountain stream Pomaret, the course of which has been partially diverted, passes through a second tunnel 1,194 feet long, and farther on through a third tunnel 564 feet. At the exit of this tunnel an underground station has been built, beyond which the line passes through a fourth tunnel piercing the mountain of Vallvidrera. This tunnel, 1 mile, 175 feet long, is the most important work on the extension on account of the difficulties encountered in its construction. The rolling stock of this Spanish line has been especially built to conform with the requirements of the local service and comprises electric motor cars and trailers. The cars were built by a Philadelphia company and are mounted on trucks provided with four motors of 125 horse-power. The passenger cars are closed and are 56 feet long, designed for single and double-end operation. The cars have a maximum speed of about thirty-seven miles an hour. Freight cars consisting of a platform mounted on two trucks with two compartments for the motorman are also in use both for transporting general merchandise as well as the company's construction material in continuing the line, which in due course will be extended to the interior towns of Tarrasa and Sabadell, and eventually farther.

# Concreting a Railroad

## Monolithic Construction Being Freely Substituted for Wood and Iron

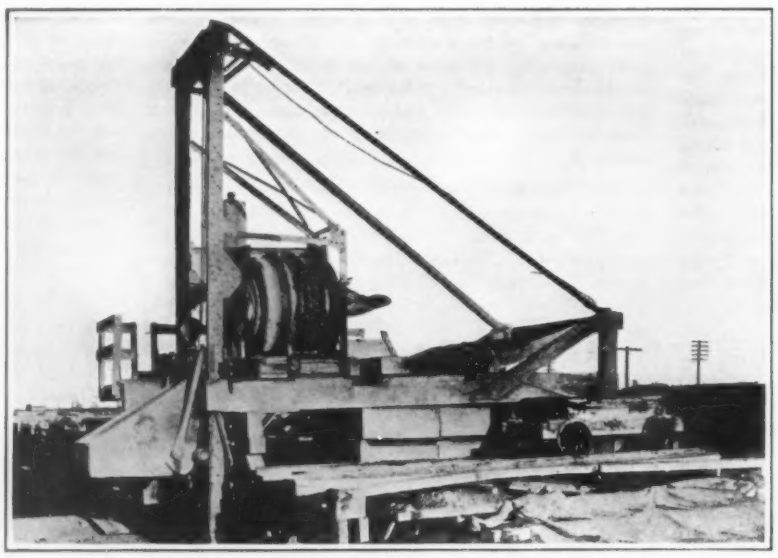
By R. P. Crawford

THE important role that concrete can be made to play in the maintenance of a railway right of way is being demonstrated by the Burlington railroad. Not only is that road making heavy use of reinforced concrete construction but it is also demonstrating how the work can be done efficiently and, most of all, economically. The plan embraces important steps looking forward to a rapid extension in the uses of concrete by American railroads as well as a standardization of product. The concrete gang along the right of way has been done away with to a large extent and the major part of the work for the entire system has been concentrated at plants maintained at Galesburg, Ill., Hannibal, Mo., and Havelock, Neb.

One of the problems that confronts the engineering department of every railroad is the construction and installation of bridges and other improvements along the right of way. Especially was it true that in the case of concrete projects practically all of the work had to be done on the spot. Under the new plan a large part of the work is done at one of the factories and a bridge can be shipped out practically complete, only the construction incidental to its installation being done along the right of way. In other words the job comes to the factory instead of the factory going to the job. Heavy savings are being effected by standardizing the work and a bridge erected under the new system costs substantially less than it would have a number of years ago, despite the advances in price of material.

Bridge decks and bridge slabs in standard sizes as well as piling to go with them, watering troughs for stock yards along the way, concrete fence posts and even curbing for the depot platforms are being turned out. When one considers that a reinforced concrete fence post can be manufactured for about twenty-two cents, or practically the same as a wooden post, the efficiency involved in the plan is apparent. A maximum force of twelve men in the factory at Havelock can in a year's time turn out, among other things, about 50,000 fence posts, 300 bridge slabs and 10,000 feet of platform curbing, not to mention enough watering troughs to meet all the railroad's stockyard requirements west of the Missouri River. And it must be remembered that most of the work can be done only during the warm season of the year.

Traveling crane unloading sand in the concrete yard



The concrete mixer, mounted on rails for moving to any part of the yard

Reinforced concrete slabs and piling for the small bridges are kept on hand in standard sizes and can be supplied to any point along the line on short notice. The slabs which form the bridge floors come in 14-, 16- and 20-foot lengths. In reality they are huge blocks of reinforced concrete. Each unit is 7 feet wide, and two of them are placed side by side to attain the 14-foot width of the standard single-track bridge. Each slab has a 6-inch parapet on one side, insuring a parapet on each side of the bridge. Ties are laid on the series of concrete slabs and the rails on top of these. The whole is filled in with gravel, giving the bridge the appearance of being part of the regular roadbed. The ballast on the bridge makes the track much easier riding and to the uninitiated the fact that a bridge is being crossed is not noticeable without a look out of the car window. Here another innovation comes into effect. Whereas, in the past the bridges have been maintained by special bridge men, now the regular track men are made responsible for their condition. The piling for the bridges is manufactured in standard lengths of from 14 to 30 feet, and practically an entire bridge is shipped out ready to be installed.

Besides the slabs for the small bridges, concrete decks are also manufactured for the flooring of steel bridges. These are 5x14 feet in size, each slab extending clear across a single track bridge. Ties are laid on the slabs and filled in with ballast the same as in the case of the smaller bridges. Naturally there is a much smaller demand for this sort of slab, since there are comparatively few long bridges.

While most railroads are now adopting the concrete bridge, a good share of them maintain the concrete gang along the line as a solution of the problem. This means that a much longer time is taken for the work and with several such jobs going on a much larger force of men is required for concrete work. Under the new system there still remains considerable work to be done in installing the bridge and in some cases the old plan of building a bridge on the spot has to be resorted to on account of peculiar conditions involved.

The concrete plant at Havelock occupies a space about five blocks long and 60 feet wide. One frame building is devoted to the manufacture of fence posts and another building to making concrete watering troughs. The heavier work, such as the manufacture of reinforced concrete slabs, is done out of doors during the warm season. An overhead crane extends across the entire plant, running on a railway with one rail at each side of the concrete yard. In that way the loading upon cars of bridge slabs, some of which weigh twenty-six tons, is easily accomplished. The concrete mixer for the outdoor work is mounted upon a platform extending across the line of molds and running on rails at either side. In that way the mixer can easily be transported to any part of the yard where it is desired to work.

The building devoted to the manufacture of watering troughs of course has its own concrete mixer. A system of narrow gage tracks with little cars carrying the trough molds connects the building with the outside yard. When the manufacture of a trough has been completed it is run out of the building on one of the cars and deposited in the yard. In that way all the trouble of handling them by hand is practically done away with. The concrete trough is a marked improvement over the old wooden trough and affords sanitary drinking conditions for the stock being transported over the road.

Practically all of the concrete fence posts are made at the plant at Havelock. This part of the work is done in speedy fashion with a specially devised machine. The

(Concluded on page 267)

General view of the railroad concreting yard at Havelock, Neb. The cars in the foreground carry molds for concrete water-troughs

The corner of the yard where the huge slabs for the standardized concrete bridges are made. A pile of finished slabs is seen at the right

# Satirical Medals of the War

## Over Two Thousand Varieties Have Been Struck or Cast in Germany Alone

By Albert A. Hopkins

NO history of the great war would be complete without taking cognizance of the money, the medals and the stamps of the belligerents. Coins are not usually affected by wars except the uttering of siege pieces in time of great stringency and by the issuing of paper money and near-money and metallic tokens for the use of prisoners of war. The stamps with their surcharges, their red cross surprintings and whole new issues bearing warlike emblems and surtaxes are always interesting and have been fairly numerous. It is, however, the medals that are the most important and far more numerous than all the stamps, coins, and paper money combined. In Germany alone, over two thousand medals have appeared and one catalogue of an Amsterdam dealer has 122 pages listing 1,209 items.

The interest is mostly in the German medals which are so numerous and well-executed. The satirical medal existed in the Middle Ages and ran the gamut from simple puns to deplorable exhibitions of rage at enemies. The medal as a medium for satire and hate did not break out very strong until the present war was well launched, then all the flood gates of passion were let loose and we have sublimated hate struck in enduring form. Most, practically all, of the medals are directed against England.

The "Lusitania" medal is perhaps the most interesting medal of the lot. On one side we have a window with the legend "*Cunard Linie*" with death as the ticket seller and numerous prospective passengers hastening to buy tickets on the ill-fated vessel. Above is a legend which may be freely translated as "Business before Everything" referring to the nation of shopkeepers. The other side which we illustrate, shows the mighty vessel in her death agony. Inscribed on it are legends "No contraband can pass" and the fact that the big Cunarder was sunk by a German "diving boat." Unfortunately, the date is two days ahead of the time when she disappeared beneath the surface near the Old Head of Kinsale. Some numismatists consider that it was an accident, but it is hard to make a misprint in a die.

The two Von Tirpitz medals shown are dated February 18th, 1915, and show Germany as Neptune rising from the sea to strike men of war, and merchantmen—all grist to the mill of the uncanny and then little understood raider. The legend "*Gott Strafe England*" has awarded them the title of "medals of hate." These medals commemorate the challenging of the ages that "Brittania rules the Seas"; she certainly does not under the sea. This is a medallic representation of "*Der Tag.*"

It would really seem that Uncle Sam might have been left out of the satiric medals, but the ease with which munitions were made and exported was too much for the medallist and on one side we have President Wilson gotten up as a Roman Emperor with a laurel wreath and eyeglasses with the legend "Liberty, Neutrality, Humanity." On the reverse is Uncle Sam seated on a pile of cannon balls levelled off so as to make a secure seat. In the background is a cannon while in one hand he holds a submarine and in the other a sack of gold bearing the number 100,000 and the legend reads "America's Neutral Commerce."

One of the most amusing and harmless of the medals shows a Scotchman aiding the progress of an Indian elephant with howdah complete. On the other side is a triumphal arch with an Indian running through it with the words "Grand Attraction—des Indiers—Marseilles," this was to commemorate the landing of Indian and African troops at Marseilles. The Germans always resented the introduction of such troops into the conflict.

The last German medal shown is an oval placque with the busts of the Czar, the King of England and President Poincaré, in the center the latter's hands encircling them all, but between are a Turco, an Indian, a Zouave and a Japanese: at the top is "*Kulturtraeger.*"

At first the medals were struck in bronze, but soon the Government forbade the use of copper in the arts, and base alloys, copper plated took their place, and the latest ones are made of iron. These medals are all fairly expensive and are very hard to import as the British Government does not allow the export of articles of German origin. They can, however, be exported to neutral countries by securing a permit from the Board of Trade, Commerce Department, Gwydyr House, Whitehall, London. After all the red tape is unwound the medals will probably stand the buyer about $7.50 each.

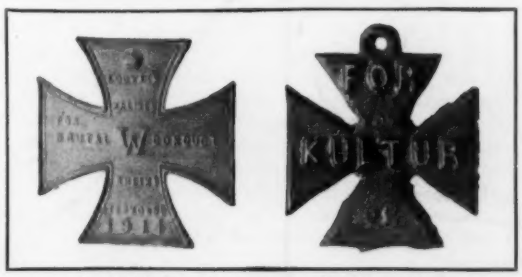
We show a Belgian medal made in Holland, commemorating the death of Edith Cavell. The satiric medal made little progress in England, but their humor took the form of making bogus "iron crosses" which were attached to dog collars and were sold for one penny.

We show two of them, one "For Brutal Conduct," and the other "For Kultur." They soon tired of this when they realized the sternness of the war and that this was a time when the making of munitions was more to be desired than in making derisive souvenirs.

The "Lusitania" medal dated two days in advance

A German conception of our neutrality

"Gott Strafe England."—Medals of hate



English bogus iron crosses for dog collars

Medal commemorating landing of native troops at Marseilles

Medal commemorating the alliance of Entente Powers with colored races

Belgian Edith Cavell medal

The future historian will find much valuable material in the medallic records of the World-War. The specimens illustrated are shown through the courtesy of Mr. Howland Wood, Curator of the American Numismatic Society, in whose cabinets in upper Broadway, they lie.

### The War, the Reindeer, and the Aurochs

ONE of the most curious reactions exerted by the European war is upon the fate of two specimens of the large European fauna, which have survived from prehistoric times, the reindeer and the aurochs. Both have an immemorial connection with man, as evidenced in tradition and in primitive art. The former, indeed, is familiar to and beloved by millions of children not only in Europe and America, because of its fabled association with the Christmas saint, and many of us, therefore, will feel a sentimental pang on learning that an animal so picturesquely appealing as well as so useful is threatened with practical extermination in its familiar haunts in the not too distant future. Such a possibility at least is suggested by Mr. Chas. Rabat in a recent number of *La Nature* (Paris). We learn from this that the Swedish government has had a serious problem on its hands of recent years owing to the bitter quarrels between the agricultural colonists in the northern provinces of Norbotten and Vesterbotten and the pastoral natives whose herds of reindeer constitute their principal livelihood. The situation in fact is strikingly analogous to the feuds in our own western states between cattlemen and farmers.

Strangely enough the war has offered the government in Sweden a means of settling the disputes referred to in a manner satisfactory to both parties. The authorities of Stockholm have given to the German agents seeking to buy meat in Sweden permission to ship to Germany 43,500 carcasses of reindeer, which it is estimated will provide about 3,480 metric tons of venison. Since local merchants are ordered to retain for the home market an amount not less than 15 per cent of the number exported, it is reckoned that some 50,000 head of the deer were slaughtered at the beginning of the present winter, a serious inroad into their numbers, which, in the six years from 1905 to 1911 had increased from 225,000 to 275,000 head.

"The Lapps are divided into pastoral, sedentary, and forest herdsmen of reindeer. The first conduct their herds to the northern mountains of Norway, where such of these nomads as are of Swedish nationality possess rights of forage, after which they return to winter in the forests of northern Sweden. . . . The sedentary owners never quit this same wooded zone where they derive their living from the chase, from fishing, and from the cultivation of a few fields of rye and potatoes. These natives likewise possess a small number of deer which they keep near their habitations. An intermediate class between these two is formed by the forest Lapps. As their name indicates, these are also installed in the wooded region of northern Sweden, where, like the 'sedentaries,' they live by hunting and fishing, and sometimes by a primative agriculture; but like the pastoral tribes they devote themselves to the breeding of reindeer, though without making long migrations. . . . Since the end of the nineteenth century the colonization of Swedish Lapland has made great progress. In Norbotten, the most northern department, the population increased from 104,000 to 168,000 between 1890 and 1913. In Vesterbotton there was a gain of 44,000 in the same period. These immigrants have mostly settled in the forest, which they have cleared by stubborn labor to make small farms where they breed cattle and undertake the task, always precarious, of raising a few fields of rye and potatoes.

"Because of this colonization the extent of territory open for forage to the 'foresters' has been reduced; hence the numerous complaints by these natives, who, because of undisturbed occupation for centuries, regard themselves as proprietors and the colonists as intruders. . . . To revenge themselves for what they consider a trespass on their domain they take a malicious pleasure in driving their deer into the fields of the colonists.

(*Concluded on page 268*)

# A Week's Review of the War, March 1st, 1917

**By Our Military Expert**

THE extremely unfavorable weather for some time has held the eastern or Russian front in its grip; as a consequence little of real interest has taken place there. Fighting on the Riga front, especially on the Aa River, has continued without decided advantages to either side. The Germans have been making strong efforts to regain ground that has been lost here and to resume the offensive in force. Farther south in Galicia there have been some minor operations with little practical results. The Russians in Bukowina have assaulted strong lines to the southwest of Kimpolung along the heights of Jacobeni and the Golden Bistritza River, close to the borders of Bukowina and Rumania. Any successes here might allow an advance not only into Hungary but also down the valley of the Bistritza River toward its junction with the Sereth and would thus permit taking in flank some of the Austro-German positions to the east of the Carpathians and along the middle reaches of the Sereth. At present the Austro-German-Turkish-Bulgarian armies are well entrenched along the Sereth in Rumania with little or no occasion for fear of disturbance while winter lasts. Meanwhile it is reported that large quantities of grain and other provisions and supplies are being taken from Rumania to Austria and Germany, not only by rail but also by steamers and barges on the Danube—which river is also largely used for the transportation into Rumania of troops and war munitions of all kinds.

But, while the cold weather has hindered military operations in the eastern front, the contrary has been the case in the west where the usual mud has at times been frozen sufficiently hard to permit of troop movements, trench operations, and reconnoissances. The great question has been: Where will the Allies' heaviest blows fall in the spring advances so long prepared for by them and a cause of so much uneasiness to the Germans?

Just a year ago the battles around Verdun began almost before the snows had melted and in many places before the ground had dried sufficiently for extended troop movements. This year it is the British who have practically kept up the battle of the Somme, during the winter by trench raids and minor operations, but who are now continuing and extending their offensive with a view of capturing the important positions of Bapaume and Peronne. They began by capturing on February 16th the hills in and near Sailly Saillissel and some points to the southeast in the vicinity of Peronne. The fierce struggles in the operations of the last few days have resulted in the capture of Baillescourt Farm northeast of Beaucourt which is north of the Ancre River and west of Bapaume. As the English troops were also moving up to Grandcourt on the south of the river, that village was rendered untenable and was abandoned by the Germans. These movements gave the British important new ground on both sides of the Ancre River, which muddy little stream may soon rival in dispatches the Somme or the Yser. As the British advanced, they took the dominating ground on both sides of the river; the advantages were such that the German forces have abandoned Miraumont, Pys and other points; they have pushed forward almost two miles on a front of eleven miles and are now east of Gueudecourt. Their front is now well toward the Bapaume ridges to which the Germans are retreating. The British have pushed forward north and south of Serre which has also been abandoned by the German forces. Up to the time of the retirement of the German forces, the fighting was reported as most violent, both sides claiming to have inflicted severe losses on their assailants. It was evident that before their final withdrawal the Germans were fully prepared for the evacuation of their trenches and positions, everything being destroyed that could not be moved away and their positions being converted into a mass of wreckage by explosions and fire.

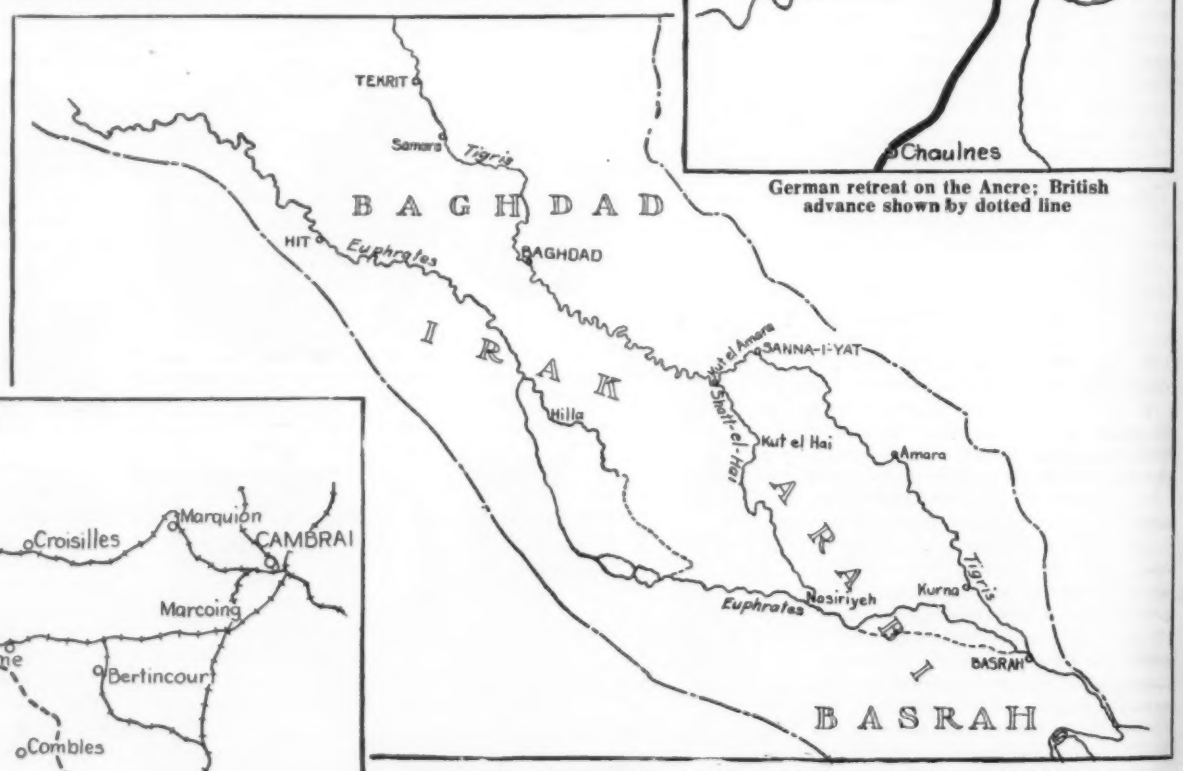
The present object of the British forces is a crest or range of hills overlooking the high ground around Bapaume. The latest reports place the British forces almost one mile from Bapaume and this village may be captured before the present article appears in print. It cannot be fully determined what is the plan of the German high command in the present retirement, but it seems to have been in mind for some time. It has been well known that British pressure would be applied with all its power when the spring advance began and it can be safely assumed that, if the old lines have been given up, new, shorter and perhaps much stronger defensive lines have been fully prepared by the Germans at points already selected well to the rear of the present positions.

**Principal railroads about Peronne and Bapaume. German trenches marked by dotted line**

All the movements of the British illustrate the pincers methods of capturing desired positions. Once Peronne on the one hand and Bapaume on the other are made the apexes in the German lines by enemies that have advanced on either side, their abandonment or the surrender of their garrisons is certain to occur. The present operations on the part of the British are preliminary to the capture of both places, thus endangering the railroad communications in the sector Arras-Cambrai-St. Quentin-Chaulnes. Once any of the main lines running north and south in rear of the present German positions are reached, a retirement of the troops in such a sector supplied from these lines becomes absolutely necessary. In the special case of Bapaume, a break in the German lines would straighten the French front from Arras to Peronne—now quite a well defined curve, with Arras at the north, Bapaume at the advanced center and Peronne in the south. The increased British activity on the northwestern end of the Allied lines in the neighborhood of Ypres and Amentières indicates reconnoissances in force to feel out the German positions in the vicinity of the River Lys. This country is generally flat and consequently the Germans have constructed there strong defensive field works.

As a whole the part to be taken by England in the spring and summer campaigns is manifold. It is evident that there is to be a general drive or thrust forward in northwestern France and Belgium; the present campaign on the Tigris will hold the Turkish forces busy there, or will destroy them entirely so far as effective resistance is concerned. The Salonica columns will keep the German-Bulgar forces occupied, while the Italian forces will keep the Austrians busy on the Italian fronts. On the other hand, Russia will no doubt soon begin a forward movement along the Galician and Rumanian fronts after a winter's preparation. France with her own miles of front to protect will keep strong German armies to resist her pressure.

**German retreat on the Ancre; British advance shown by dotted line**




**Southeastern Mesopotamia, showing principal towns, and scene of British success**

Recently the Germans captured about a mile and a half of trenches to a depth of a half mile in the Champagne region south of Riport; this point is on the main road to Tahure about midway between Verdun and Rheims. This assault appears to have assumed the character almost of a real battle, as attacks and counter-attacks followed from each side. While this may be the beginning of greater attacks, no great tactical advantage, other than protection to the railroads in rear, can follow from it. Its only result can be to encourage the German Army and German poeple, whose painful economic condition is affecting the morale not only of the non-combatants but also of the men in the trenches. In general, the latest moves of the Germans around Bapaume and Peronne would indicate an entire change, from the dreadful frontal assaults and consequent holocausts, by giving up unimportant positions to retire to more strongly fortified fronts. There can be little doubt too, that the German railway systems on all sides are being strained to the breaking point; the roads and rolling stock at the beginning of the present war were in the

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# Correspondence

*(The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.)*

## The Question of the Battle-Cruisers

To the Editor of the SCIENTIFIC AMERICAN:

Your issue of February 24th carried a letter by M. M. Alger on the subject of electric drive for battle-cruisers. There are far more serious points involved than those raised by Mr. Alger, who seems to be so busy "picking up the chips that he does not see the logs drifting by."

There are a few fundamentals which, heretofore, have decided such issues as the one now under discussion. These are weight, cost, economy, reliability of the machinery and protection:

*Weight.*—Several of the largest shipbuilders are prepared to prove by detail estimates to any investigating board of engineers that the adoption of the geared drive in place of the electric drive would insure a net saving on each ship of at least 1,000 tons. This saving in weight is net saving on the ship after all details such as shafting, steam pipes, fuel, cruising turbines and changes have been taken into account. There seems to be no one ready to show by similar detail estimates that this saving in weight will not result.

*Cost.*—The shipbuilders are also prepared to prove by detail estimates that the battle-cruisers if equipped with the geared drive can be built for at least $1,300,000 less per ship than if equipped with the electric drive. In fact, the president of one of these companies at a hearing before the House Naval Committee weeks ago offered to guarantee this saving of $1,300,000 per ship. Here, too, no one has come forward ready to show by detail estimates that this saving in cost will not result.

*Economy.*—Even the engineers of the Navy Department admit that the geared drive is the more economical at full power. It must be borne in mind that these ships are battle-cruisers and that both speed and the ability to maintain top speed are of vital importance. The maximum speed attainable and the ability to maintain it certainly depend on the full power economy.

One of the two largest electrical companies in this country submitted to the shipbuilders plans and guarantees covering both the electric drive installation and the geared drive installation. This company offered to guarantee better economy with the geared drive than with the electric drive even at very low cruising speeds.

Independent estimates prepared by one of the shipbuilders and based on another type of turbine showed the geared drive to be more economical at full power, equally good at intermediate powers, but not so economical as the electric drive at low power. This shipbuilder, however, stated in a letter which accompanied his bid, "By the introduction of cruising units, not shown in this company's design because of lack of time, equally good economies can be obtained at the lowest speed to those obtained by the electric drive." On the result of these estimates, the shipbuilders must base their guarantees to the Government and failure to meet these guarantees means heavy penalties. Surely then, they are not attempting to fool themselves.

*Reliability of the Machinery.*—The new British Navy which has been laid down since the war began is almost exclusively composed of geared drive ships, covering the entire range from destroyers to battle-cruisers of 165,000 horse-power. It has been reported that one gear set broke down, but later reports say that a careful analysis has proved that a foreign substance such as steel filings or something of similar nature had been deliberately put into this gear to damage it and that a workman charged with having done this has since been placed under arrest. The geared drive ships in the British Navy to-day total several million horse-power.

*Protection.*—Under this head must be considered the underwater protection against torpedo and mine, and the above water protection against shell fire. With the electric drive it has been found necessary to put one half the boiler plant above the protective deck, where it is exposed to shell fire.

Admiral Griffin, Chief of the Bureau of Steam Engineering, in his letter of January 5th, addressed to the Chairman of the House Naval Committee says, "The advantage in having all the boilers below the protective deck is great, provided they can be given adequate protection against torpedo attack."

Admiral Taylor, Chief of the Bureau of Construction and Repair, at a hearing before the Senate Naval Committee in referring to the Navy Department's attempt to arrange all the boilers below the protective deck and still be able to use the electric drive said, "Yes, I did wish to convey the idea that if we put them below we would have less protection than we have now for the ship below water." In other words the electric drive machinery occupies so much space that there is not room below the protective deck for the electric drive machinery, the auxiliary machinery and all the boilers without encroaching on the compartments set aside for protection against torpedo and mine.

Thus, one bureau chief admits that the placing of half the boilers above the protective deck is a great source of weakness and another bureau chief admits the fact that this defect cannot be remedied, if the electric drive is used, without sacrificing underwater protection. With the geared drive, however, the shipbuilders have shown how all the vitals, boilers included, can be placed below the protective deck *without sacrificing any of the underwater protection*. This can be done because the turbines and gears in the geared drive occupy only about the same space as the motors in the electric drive and the extra space needed for the turbines and generators in the electric drive is available for boilers in the geared drive arrangement.

Mr. Alger is in error in saying, "No turbine has been developed that will give high efficiencies both at maximum and cruising speeds." Such turbines have been developed and are building for the geared drive destroyers and geared drive scout-cruisers recently ordered and such turbines are proposed for the battle-cruisers. Some of these turbines give nearly as good economy at one fifth full power as they do at full power.

Mr. Alger says, "Another advantage of this system is, that breakdown of one turbine does not put the ship out of action." It seems hardly credible that any one would attempt to enter into a discussion of this character who does not even appreciate the fact that these ships have four shafts and that with the proposed geared drive each one of these shafts is driven by four turbines delivering their power through four separate independent pinions. If any one turbine breaks down there are 15 others still capable of efficient action. With the electric drive, however, there are but four turbines, and if one of these turbines breaks down one fourth of the power is gone.

There is, as Mr. Alger says, a loss due to rotating the reversing turbine, but this has been allowed for in the economy estimates. As may well be imagined this is a very small factor in a 45,000 horse-power unit. It is practically possible with the geared drive, to furnish all the backing power any operating engineer would dare to use and as quickly as he would dare to use it. This talk of suddenly reversing by simply throwing a few switches is nonsense. With the electric drive there is a reduction in steam piping, but a far more dangerous substitute is made; that is high voltage electric cables, which are far more subject to rupture by fragments from bursting shells than are the heavy steam pipes.

In view of the fact that there exists such a decided difference of opinion between the engineers of the Navy Department and the equally interested and capable engineers of the shipbuilders on the merits of the two systems of drive, it seems very reasonable to ask that a board of impartial expert engineers be appointed to hear both sides and make a recommendation to the Secretary. This is repeatedly done in the medical profession, in the legal profession and also in the engineering profession without involving any reflection upon the professional men concerned.

E. R. NEWTON.

New York, N. Y.

## About That Nantucket Cable

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of January 20th, 1917, you publish an article relating to the laying of the submarine telephone cable to Nantucket Island and in view of your well established reputation for accuracy I am taking the liberty of addressing this to you in order to correct what appears to me to be a misstatement by Mr. Kline, who is quoted in the above article as follows: "We laid the Vancouver cable, the longest telephone cable in the world, but these 24 miles are my top-notchers."

Mr. Kline apparently refers to the Point Grey-Newcastle Island cable which was laid in June, 1913, which, I was informed at that time, bore the distinction of being the longest telephone cable in the world; but if he makes use of the statement attributed to him as above, I am inclined to believe that he is in error. I personally superintended all the operations in connection with the above cable, including the laying of the working section of approximately 28.6 nautical miles, from the time it arrived in Vancouver till the balance of spare cable was coiled into the British Columbia Telephone Company's tank.

While the actual laying was in progress, a number of guests representing various telephone and telegraph companies from all over the continent were present, and possibly Mr. Kline was among them; but if such is the case, he was in the rôle of a guest only and had nothing whatever to do with operations in any shape or form.

A. RICHARDSON.

Seattle, Wash.

## One Reason Why the Farmer Does Not Produce More

To the Editor of the SCIENTIFIC AMERICAN:

Your recent article on the decreasing food supply put it in my mind to write you about a great economic wrong that can and ought to be righted, namely the great discrepancy between what the producer receives and what the consumer pays for food products.

I was raised on a farm and still have friends and relatives in the business and it is no exaggeration to say that the city dweller is paying from two to six times as much as the producer receives for all food products and the average is nearer six than two. The average income of all the farmers in the United States is not over $2 per day and a farmer's day is from twelve to sixteen hours of the hardest kind of labor which accounts for the increasing percentage of city dwellers among our population.

If the farmer would combine and fix prices it would solve their problem but would not help the city dweller any. It would be a great help if the United States Government would inaugurate a second-class in the parcels post service for forwarding packages up to 150 pounds by fast freight at about a third the rates per pound charged for forwarding on passenger trains and so make it possible for the city dwellers to buy direct from the producer to the advantage of both. The farmer's problem is not merely one of producing, but of producing something he can sell at a profit and he has found by sad experience that a short crop often nets him more than a large one and many a crop cannot be sold for enough to pay for harvesting after he has gone to all the work of raising it.

H. A. WILTSE.

Miami, Arizona.

## Preserving Wood From Insect Attack

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of December 9th, last, appears an article on "Combating the Attacks of Termites or White Ants." An excellent preventive and combative measure, not given in this article, has recently been patented; and, as it is rather ingenious and may prove to be very useful, I have no doubt it will be of interest to my fellow readers of the SCIENTIFIC AMERICAN:

Wood, or other material, is first treated with a solution of sodium arsenate and, immediately afterwards, with a solution of lead acetate. The result is the precipitation of plumbic arsenate within the pores of the wood. This salt is insoluble in water, but soluble in the digestive juices of animals. It thus becomes poisonous to white ants and other organisms, and so preserves the wood from their attacks.

L. H. EVERHART.

Elkridge, Md.

## The Fuel Problem

To the Editor of the SCIENTIFIC AMERICAN:

I believe the great need to-day is fuel economy, now that coal is so scarce and oil has nearly doubled in price. Your fine publication is read by the railroad presidents and the factory and power plant heads who do not see the average technical trade magazines. It lays in your power to educate the man whose word is law and whose decision is final. The use of pulverized coal, the most striking example of fuel economy, with its many instances of permanent success in great smelters and power plants as well as under locomotives and steam boilers, would, I believe, be of interest to every thinking American.

This is the age of industrial efficiency. The power plant is the heart of American industry, and its generating plants are sadly neglected.

W. W. HORNE.

Chicago, Ill.

## Exhaust Gases

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN dated February 3d, 1917, under article a timely "Don't" for the Motorist regarding exhaust gases:

Having been overcome by exhaust gas from a running motor in a small garage myself, I find that a good way to overcome this (providing your exhaust pipe and muffler are tight), is to get a long piece of hose, or long enough to reach out through a hole in the wall or open door, or window. Inside diameter of hose to be slightly smaller than outside diameter of exhaust pipe, and force hose over exhaust pipe and lead hose out of building.

This arrangement will carry all exhaust gases outside without disturbing you.

G. A. B.

Newtonville, Mass.

## Will o' the Wisp

To the Editor of the SCIENTIFIC AMERICAN:

The large black, the black and white, and the hydrophobia skunks are phosphorescent in darkness, giving off a continuous blue flame, the head being of a more fiery red, then tapering off into blue to tail tip. This fact may answer in a degree for the blue marsh gas flame, the jack o' lantern and ma lantern (of the southern states), and the night ghost lights of all states. I make this suggestion from my experience in trapping in deserted mine tunnels in this state.

PATRICK BRENNAN.

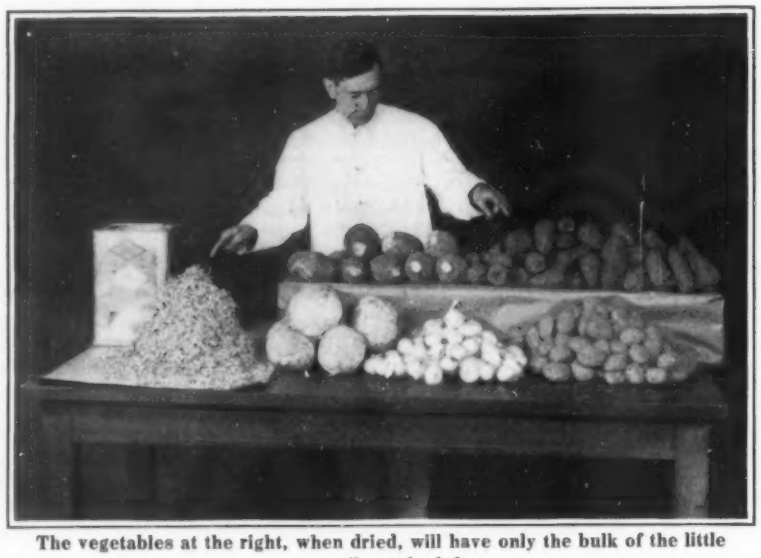
Phoenix, Ariz.

# Feeding the Nation

## A New Drying Process that Promises an Economic Revolution

By R. G. Skerrett

WITH good reason, the world has wondered much during the better part of the past two years how Germany has been able to feed her people in spite of the blockade maintained by her foes. Unquestionably, a notable part of her self-sufficiency has been due to the widespread adoption of drying processes to preserve vegetables, fruits, and grains that might otherwise have been sacrificed through deterioration or decay. The dehydrating factories or plants have made it possible to convert these perishable products into foodstuffs that could be kept for many months without much loss in their nutritive properties. How extensive this industry has been for some years back can be gathered from the fact that just about three years ago there were more than 425 drying establishments in the Fatherland, and these have been added to greatly since the outbreak of hostilities. Latterly, the German authorities have placed evaporating plants in all of the good-sized cities, and these have served to take care of temporary surplus of farm products, thus conserving, for the days of shortage, fruits and vegetables that otherwise would have gone to waste.



**The vegetables at the right, when dried, will have only the bulk of the little pile at the left**

A conspicuous economy has been effected in Germany through the drying of potato tops and beet tops for fodder. Prior to the desiccating of these leaves it was the practice to store in silos quite two thirds of the beet tops, and because of unavoidable fermentation a very considerable part was spoiled. The drying treatment has eliminated this wastage, and has made it possible for the Teutons to maintain their livestock in an extremely economical manner while fattening them to the desired degree for the market.

The German process for the preservation of vegetables has consisted in partly boiling them first to arrest certain organic changes and then in drying the products for preservation. The high temperatures cause a further radical alteration in physical appearance and chemical properties. To make them fit for the table, these desiccated vegetables require recooking, and, while unquestionably nutritive, they are not overpalatable nor do their flavors closely resemble those of the fresh growths. Even so, the Germans were admittedly masters of this art until a year or two ago, when a rival American process was perfected.

The essential features of the American process, which has been patented and is in operation at three plants in the United States, consist in using heated air at temperatures far below those employed abroad and in insuring a thorough circulation of the air currents so as to reach every particle of the fruits or vegetables undergoing desiccation. Consequently, the final yield of the drying apparatus is quite different from similar products treated by the German systems. To begin with, the moisture is extracted so that the residual water is well inside of 12 per cent, and the desiccation does not injure the cellular membranes of the vegetable matter. The evaporation—depending upon the original water content of the vegetable or fruit—is accomplished within the remarkably short period of from two and one half to five hours. This is in notable contrast to the six and eight hours, and even much longer, required generally by other systems in which the removal of the water content ranges commonly well above twenty per cent. As a consequence, the vegetables and fruits dried by this American system retain to a remarkable degree their fresh taste and full flavor when prepared for the table; and because their cellular structure is uninjured they reacquire a normal appearance in a short while after being soaked in water.

It is authoritatively stated by the United States Department of Agriculture that quite fifty per cent of the vegetables and fruits grown here never reach the consumer's table; and it is equally certain that the major part of the produce so sacrificed does not leave the farm or orchard. This is because of difficulties of transportation, and the state of the market, combined with the fact that only the very best of the fruits or vegetables will pass final inspection or lend themselves to profitable shipping. Nevertheless, by far the greater part of those products that do not leave the farm could be saved and made available by drying. Not only that, but this new process shows that the yields of farm and orchard can be conserved so as to keep well nigh indefinitely, and can be marketed at a price well below that of the so-called fresh products to be had only at certain seasons of the year.

**The bucket and milk bottles contain the water extracted from this box of vegetables**

**This barrel of dried stuff represents thirty barrels of green vegetables, and will make soup for 6,000 men**

The economic aspect of this matter is twofold. First, the farmer will no longer be hemmed in by local markets; his produce, when dried at nearby or conveniently located plants, can be cheaply delivered as demand dictates to any point in the United States or to foreign countries. Then, too, these dried products will be a great deal lighter than the fresh fruits or vegetables, and therefore, will take up less space than in their original form. This will lower proportionately the charges for transportation and storage. A large truck load of mixed vegetables can be dried by this process so that they will weigh but a hundred pounds and fill only a single barrel. Soup vegetables of this sort and weighing but one pound will make enough soup to satisfy sixty adults. For exploring parties, for large forces of workmen engaged far from a base of supply, and for naval and military operations, this method of preserving foodstuffs promises to be of the utmost value. Because of the low moisture content, these so-called "dry-fresh" products are not liable to attack by molds or bacteria. Also, because of the very modest percentage of the residual water, the products, pound for pound, represent a correspondingly higher percentage of nutritive value.

One domestic industry, particularly, is in a fair way to be revolutionized by the perfecting of the process in question. According to the latest crop report of the Bureau of Agriculture, beet sugar factories in the United States will produce 918,800 short tons of sugar "during the current campaign." The area harvested amounted to 680,000 acres, and the beets totaled 6,671,000 short tons. The official statement issued in December past says: "This is the largest acreage and tonnage of beets ever harvested in the United States, and the sugar production exceeds the highest preceding crop, that of 1915, by more than 44,600 tons. During the past five years, the United States has consumed about 4,000,000 tons of sugar annually."

In 1915, the cane sugar produced in Louisiana amounted to 216,996 tons, and the beet sugar factories of the United States turned out in the same period 646,257 tons. This gives us some idea of the steadily growing importance of the domestic beet sugar industry located in Michigan, Colorado, Nebraska, Ohio, Idaho and Utah. It also shows that we can make ourselves independent, if need be, of outside sources of raw sugar, because the sugar beet can be grown here far more extensively than it is possible for us to cultivate sugar cane within our continental limits. There is cheer for the farmer, too, in this matter. In the less favored of the northern districts of the country, farmers confidently count upon realizing $30 per acre of sugar beets, while in California the return is in the neighborhood of $40 and more.

The growing of sugar beets heretofore has been restricted to somewhat narrow zones immediately contiguous to the factories. Wagon hauling is not practicable or profitable beyond a distance of ten miles, and transportation charges limit rail carriage to an extreme radius of a hundred miles from a refinery. Next, the so-called "campaign" or harvesting period does not extend beyond three months, and within this relatively short interval the sugar beets must be gathered and delivered directly to the factories. Even so, there are many practical difficulties that entail losses.

To begin with, the farmer naturally wants to harvest his product when his beets are biggest and the crop heaviest. The refiner, on the other hand, wants each contributing farmer's harvest delivered separately or at specified intervals, so that the regular daily tonnage to be handled will just fit in with the factory's capacity. This ideal arrangement is well nigh impossible under prevailing conditions, and, therefore, in order to take care of momentary overload, silos are sometimes installed to hold the excess beets for a while. There

*(Concluded on page 268)*

# Motion Pictures in Colors and Relief

## Describing a New Process Which Produces Pictures in Full Color by Means of a Simple Attachment on Any Projector

JUDGING from the success of the formal presentation of new motion pictures in colors, under the auspices of The American Museum of Natural History and the New York Academy of Sciences in the auditorium of the Museum in New York on the evening of February 8th, as well as the private showing in the Strand Theater for representatives of the press, it seems that the perfection of motion picture photography in colors and relief is at last an accomplished fact.

Owing to the gradual and laborious development of motion pictures in color, a brief resumé of the history of the subject is perhaps the most suitable introduction to a detailed description of the latest process.

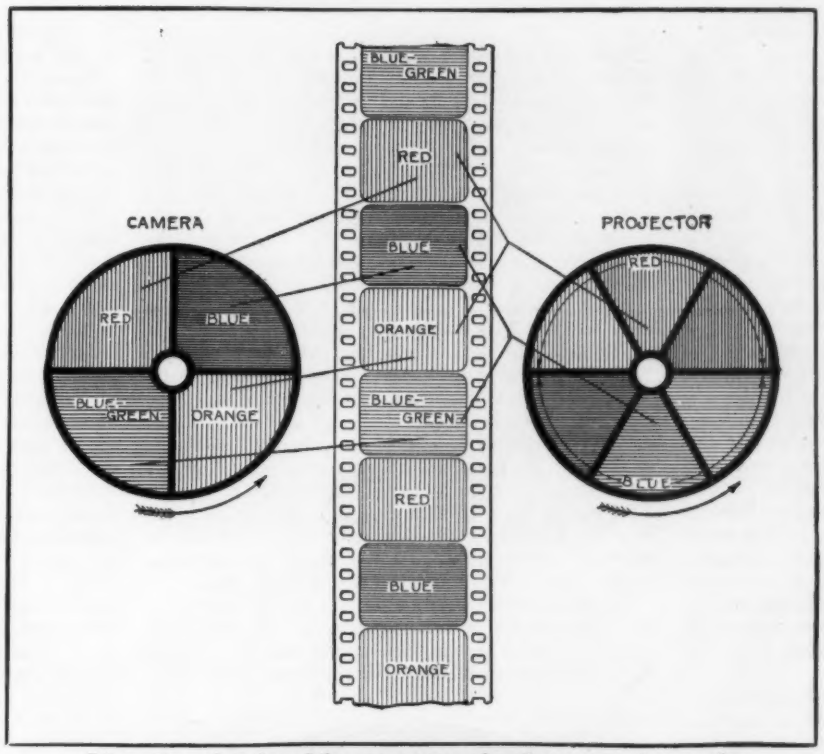
There are three primary colors, red, green and blue-violet, which, when blended in equal proportions, produce the sensation of white light. By mixing of some or all of these three colors in suitable combinations, we obtain all of the colors or shades of them. Color photography, then, is based on the decomposition of white light into these three components. This theory is usually accredited to Young and Helmholtz, although some investigators believe that in 1792 Wünsch evolved the same principle.

Clerk Maxwell, a noted English physicist, and Ducos du Hauron of France, in 1862 enunciated the broad basis upon which present-day color photography is laid. In 1889 Frederick Eugene Ives of Philadelphia did valuable work in bringing color photography to a practical working basis. Many forms of color plates for making transparencies then followed, the earliest coming in 1895, and the most successful, the Autochrome, of the Messrs. Lumiere of France, in 1904.

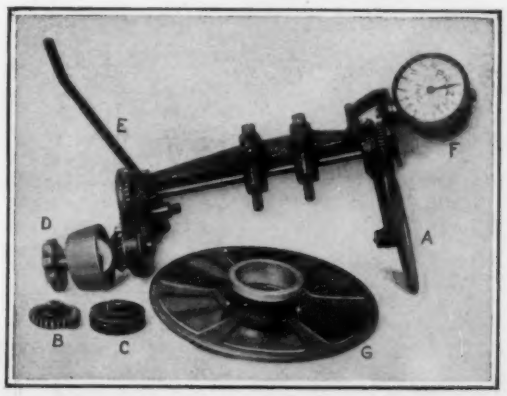
In December, 1907, Mr. George A. Smith of England exhibited a two-color motion picture process known as the Kinemacolor. This method dispensed with one of the components of white light, *i. e.*, blue-violet, and used but two, red and green, of the three primary colors. These pictures were taken and projected at double the usual black-and-white speed, or 32 pictures per second.

The next step in the production of motion pictures in natural colors was made by the Gaumont process, which was first displayed in this country during June, 1913, in New York. This process, while an artistic improvement, apparently contained practical difficulties which ostensibly have kept it from attaining commercial success.

We now come to the latest development in the production of color motion pictures, which reproduces objects at rest and in motion, and in all the shades and colors found in nature, in addition to all of the detail present in the customary black-and-white pictures. Aside from the faithful reproduction of the subjects, the new pictures display a complete absence of the objectionable color fringe found in some of the earlier processes, when fast moving objects were portrayed. Even so, this latest process has still greater advantages, namely, those of simplicity and wide applicability; for instead of calling for a special projector and thereby limiting its use to the big theaters which alone could afford the heavy expenses of this additional equipment, the new film can be projected with any standard projector after equipping it with an incomplex and inexpensive attachment, which in no way interferes with the handling of black-and-white film. Thus it is possible for the smallest picture theater, as well as the largest, to exhibit the new color films.




**Schematic explanation of the new process of motion-picture photography in natural colors and relief**

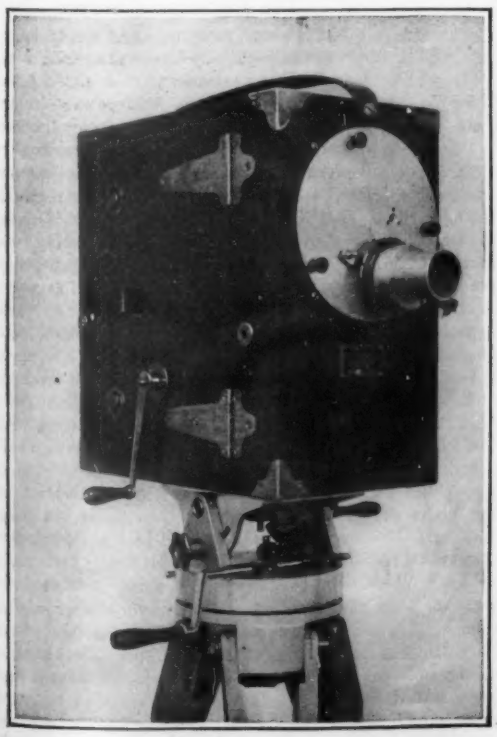



**By means of this simple attachment any projector may be utilized for the projection of the new color films**

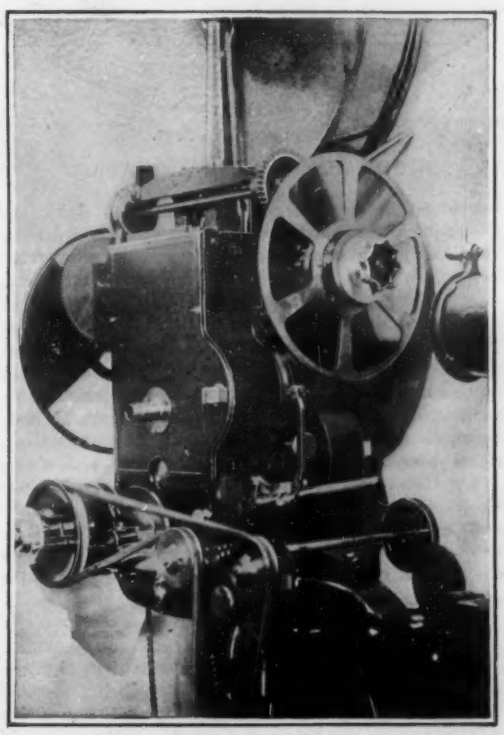
Four colors, made up of two pairs of complementary colors, are involved in the new process. The first pair is composed of red and blue-green, and the second of orange (or yellow) and blue. These four shades photographically cover the entire range of visible colors. The reduction to a substantial white from each pair of images and the fact that all colors overlap, enable the pictures to be made with but little apparent differences in densities; and this feature is further brought about by the addition of other elements in the making of the film. These factors render unnecessary special equipment other than that used in black-and-white cinematography.

In the taking of the new pictures the camera controls a single strip of panchromatic film—film whose emulsion is sensitive to all color rays—of standard width and perforation, this being pulled down step by step in back of a single lens, as in usual practice. Between the film and the lens, however, two shutters are employed, the usual one to cover the film during the period when the film is moving, and another to bring into position the color filters through which the light rays must pass before reaching the film during exposure. The color filters of the camera are arranged in the order shown in the accompanying diagram, and as each filter comes into alinement with the lens, one image or frame is exposed on the film. The camera is operated at a speed of 24

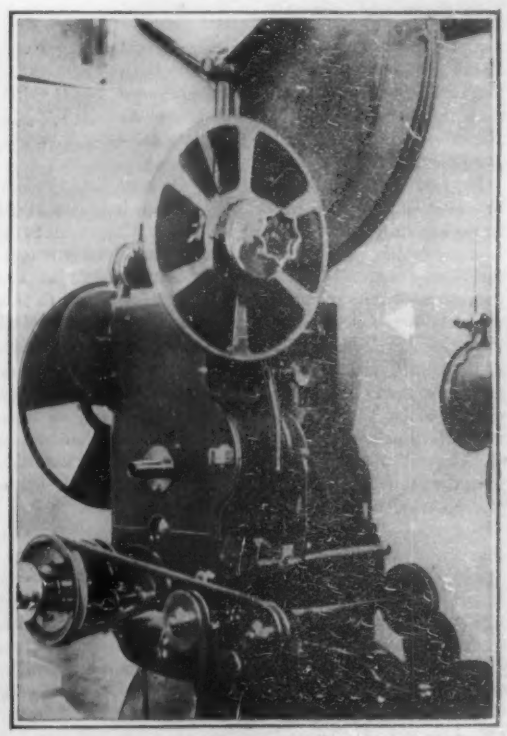
(Continued on page 269)



**Camera used in the production of the new motion-picture films in natural color and relief**



**A standard motion-picture projector fitted with a color-wheel attachment, showing the latter in place**



**The color-wheel thrown out of the path of light rays, permitting the projection of black-and-white film**

# The Heavens in March, 1917

## A Dearth of Comets Last Year

By Prof. Henry Norris Russell, Ph.D.

THE new year is old enough now to enable astronomers, as it were, to close their books for the year preceding, and take account of its discoveries. In one particular 1916 was an unusually barren year. Only two comets were discovered during the whole twelve months—the smallest record since 1901.

One of the two was so far from the sun that it has not yet come to perihelion, which leaves but one comet discovered during the year to pass perihelion in 1916; but the last comet discovered in 1915 did not pass perihelion till early in 1916, so that there are two comets after all to be accredited to the year according to their dates of closest approach to the sun, which is the method of classification adopted in the definitive catalogues of cometary orbits. We cannot be quite sure yet, though, that no more comets may be added to the list, for it is still possible—though by this time not very probable—that a comet may be discovered in 1917, on its way outward from the sun's vicinity, which had passed perihelion in the previous year, and so was to be credited to 1916.

To find an equally poor year for comets we must go back to 1901, and beyond this to 1883, in both of which years, only two comets were known to come to perihelion. To surpass this, we must return to 1876, in which year no comets at all were seen. Between that date and the present 198 comets in all have been observed, an average of almost exactly five per year—the greatest number in any one year being ten in 1898.

These fluctuations in the number of comets seen from year to year have, of course, no further meaning than an illustration that the "law of averages" does not hold for single instances. That this law does hold for longer intervals—that is, that the number of comets discovered in a longer interval does not vary very much—is well shown by the statistics of the last forty years. The number of comets observed in ten consecutive years, at any time within this interval, has never been less than 43 or greater than 56. We may, therefore, expect *decades* to be fairly similar to one another as regards the numbers of comets discovered, so long as our methods of discovery retain their present efficiency—though individual years will doubtless continue to differ widely.

The two comets of last year were, however, both interesting, the first being a short-period comet of Jupiter's family, and the second, Wolf's Comet, promising to become a conspicuous object this summer—as was already mentioned in these columns last July.

This comet is now observable in the morning sky, its position on March 6th being in right ascension 18h. 19m. 8 declination 1°5′ south, while on the 30th, it is in 19h. 16m.5, and 3° 55′ north. It is still about two hundred million miles from both the earth and the sun, and though more than twenty times as bright as at its discovery, is still observable only in a fair-sized telescope.

In July and August, however, it may become visible to the naked eye, though it is not likely to be as conspicuous as was Delavan's Comet in 1914. Like the latter, it must really be an unusually large comet, for most comets would be altogether invisible at the enormous distances from the earth and sun at which this one was discovered, but its great perihelion distance of over one hundred and fifty million miles is very much against its giving much of a display. Only the very greatest comets have ever begun to grow tails until they came decidedly nearer to the sun than this; so it is probable that in the present case we will have something of interest to the astronomer—including the amateur with the small telescope—but not attracting the attention of the casual star-gazer.

### The Heavens

The finest part of the sky is in the west and southwest, at the hour of observation indicated on the map. The whole splendid group of the winter constellations is still in sight. Orion is well down in the west, with the line of his belt pointing northward to Aldebaran, and southward to Sirius. Above the former, we find Gemini—its twin leaders, Castor and Pollux, being still high. To the left of these and below is Procyon, while the yellower and slightly brighter object between them is the planet Saturn.

The small but rather conspicuous group to the left of Saturn makes the head of the great Sea-Serpent, Hydra. This huge constellation stretches over an area of fully ninety degrees—one quarter of the whole circumference of the sphere. Its brightest star, Alphard, stands conspicuously alone, nearly due south and about half way from the horizon to the zenith. From this the long line of the serpent's body sweeps downward and to the left below the insignificant semicircle of Crater and the conspicuous quadrilateral of Corvus, till the extremity of the tail reaches the boundary of Libra.

Above this long line are the great zodiacal constellations Leo and Virgo—both very easy to recognize and remember. The key figure to the former is the familiar "Sickle"—one of the few things in the sky which really resembles its name, which is now due south, and very high up. There is nothing else in the sky at all like it, and, once learned, it cannot be mistaken. Virgo is marked by the great white star, Spica, which itself is pointed out by the line of the upper two stars of Corvus. Next to this, the most characteristic configuration is the great arc formed by the five stars $\varepsilon$, $\delta$, $\gamma$, $\eta$, and $\beta$, which lies above and to the west of Spica, and was called by the Arabs "The Retreat of the Howling Dog."

The great reddish star almost due east is Arcturus—one of the most splendid objects in the sky, which can always be found by carrying out the line of the Great Bear's tail—the handle of the Dipper—not rectilinearly but along its own curve. Arcturus, with Spica and Denebola, in the hindquarters of Leo, forms a great and very nearly equilateral triangle, which is one of the finest large figures in the sky—showing to especial advantage in the twilight, when only the brighter stars are visible.

Below Arcturus, and farther north, we find the semicircle of the Northern Crown, and beyond it Hercules, almost completely risen. Farther to the left, and about north-northeast, we come on Draco, in a singular inverted position, his head being near the horizon, his body coiling along at the same level, then bending back till it hangs almost above his head, while his tail swings high above.

The Great Bear is nearly overhead, with the Pointers almost above the Pole, and pointing down at it Cepheus and Cassiopeia are low on the northern horizon. Passing still to the left, we come to Perseus, then to Auriga, with the brilliant star Capella, and find ourselves next to the constellations with which we began.

At 11 o'clock: Mar. 8.
At 10½ o'clock: Mar. 16.
At 10 o'clock: Mar. 23.

At 9½ o'clock: March 29.

At 9 o'clock: Apr. 7.
At 8½ o'clock: Apr. 14.
At 8 o'clock: Apr. 22.

NIGHT SKY: MARCH AND APRIL

### The Planets

Mercury is a morning star until almost the end of the month, but is ill placed for observation, being south of the sun, and rising only at 5 A. M. Early in the month he may be seen just before dawn, but he will soon be lost in the sun's rays, and, though theoretically he becomes an evening star on the 29th, he will not be visible in that capacity for a fortnight or more afterwards.

Venus, too, is a morning star, but is even nearer the sun than Mercury at the beginning of the month, though probably easier to see, as she is so much brighter. On the 22d, Mercury, as he draws in towards conjunction passes her at a distance of less than a degree, but both planets are practically invisible by that time.

Mars, too, is in the same region of the heavens, but is coming out as a morning star, very slowly, as he always does. He is in conjunction with Mercury on the 23d, and Venus on the 31st; but, as he is much fainter than either of the other planets, he is even more hopelessly invisible.

Jupiter is an evening star in Aries, setting a little after 10 P. M. on the 1st, and at a quarter before nine on the 31st. According to the accepted data, he is then only about twenty per cent brighter than Sirius, though to the eye he certainly appears brighter than this would lead one to anticipate.

Saturn is in Gemini, almost due south of Castor and Pollux, and is admirably placed for evening observation, crossing the meridian at about 8 P. M. in the middle of the month.

Uranus is in Capricornus, rising about 5 A. M., and possibly observable just before daybreak if one should take a deal of trouble about it. Neptune is in Cancer, about 3° east of the star cluster Præsepe—his position on the 4th being 8h. 18m. 9, + 19° 23′ and on April 1st, 8h. 17m. 4 + 19° 29′. He is well observable in the evening.

The Moon is full at 5 P. M. on March 8th, in the last quarter at 7 A. M. on the 16th, new at 11 P. M. on the 22d, and in her first quarter at 6 P. M. on the 30th. She is nearest the earth on the 21st, and furthest away on the 5th. During the month, she is in conjunction with Saturn and Neptune on the 4th, Uranus on the 20th, Venus, Mercury and Mars on the 22d, Jupiter on the 25th, and Saturn again on the 31st.

At 11:35 P. M. on the 20th of March, the sun crosses the celestial equator, and passes over that imaginary point in the heavens called the vernal equator. At that moment, by the calendar—and usually not by the weather—"Spring commences."

There are likely to be unusually high tides on and about the date of the equinox this year, but the reason will be that the moon will be new and in perigee at about that time, and will have nothing to do with the equinox itself.

Princeton University Observatory.
February 17th, 1917.

## The Permanent Aurora

FOR about a year and a half spectrograms of the night sky have been made at the Lowell Observatory with a single-prism spectrograph of high light-power, for the purpose of testing the sky for general auroral illumination. Isochromatic plates were used in order to record the characteristic "auroral line," lying in the greenish yellow region of the spectrum. This line has been the subject of many investigations and speculations. It has commonly been located at 5570 on the Angström scale, and was once supposed to be identical with a characteristic line of krypton. Wegener attributed it to his hypothetical element "geocoronium," constituting the "geocoroniumsphere," the stratum of the atmosphere lying above the "hydrogensphere." L. Vegard, from his measurements at Bossekop, obtained a slightly different position for this line; viz., 5572.5. This would make it practically identical with the length of a strong argon line. Besides being characteristic of the spectrum of well-defined auroras, it is also characteristic of the faint general illumination of the night sky, to which the name *earthlight* has been applied. This subject was discussed in the SCIENTIFIC AMERICAN of November 19, 1910, page 394. Arrhenius, in his "Worlds in the Making," says: "Whichever way we turn the spectroscope on a very clear night, especially in the tropics, we observe this peculiar green line. It was formerly considered to be characteristic of the zodiacal light, but on a closer examination it has been traced all over the sky, even where the zodiacal light could not be observed." Mr. Slipher reports that of more than fifty plates exposed at the Lowell Observatory all show existence of a general aurora, at least for the period of the observation.

# Inventions New and Interesting

## A Department Devoted to Pioneer Work in the Arts

### A Portable Electric Power Plant for the Row Boat

THE electric motor boat has always met with favor on account of its noiseless operation and cleanliness, and in view of the success of the gasoline outboard motor it is not surprising to learn of the introduction of an electric outboard motor. Furthermore, the perfection of the storage battery, coupled with the constantly increasing cost of gasoline, makes the appearance of a portable electric power plant for the rowboat most opportune.

In general design, the present electric power plant is similar to the usual gasoline outboard motors, being readily attached to the stern of any rowboat by means of two clamp screws. The motor, which is designed to operate at a high speed, with a normal speed of 3,000 r.p.m., is placed directly above the main driving shaft. The latter is contained in a telescopic tube, allowing the propeller to be adjusted to the correct distance beneath the surface of the water. The propeller is driven through a modified type of worm gearing which gives a considerable reduction between the motor and the propeller. Above the motor is a small, horizontal steering wheel which steers the craft by throwing the propeller to the right or left, or completely around if it is desired to reverse the direction of travel. To this wheel may be fitted either a tiller or steering yoke, according to requirements. The entire power plant is made of aluminum and manganese alloy wherever possible, the idea being to reduce the weight. The motor and its equipment, complete, but without battery, weighs only 50 pounds. The standard battery for the motor comprises two 6-volt, 120-ampere-hour batteries, although a smaller battery can be employed with fair results; in brief, the selection of the storage battery is a matter to be determined by the speed desired and the number of hours of continuous running.

By means of a simple device the motor may be detached from the driving shaft and used for other purposes where power is required, thus making it a universal service motor.

**Any row boat can be converted into a power boat with this detachable electric plant**

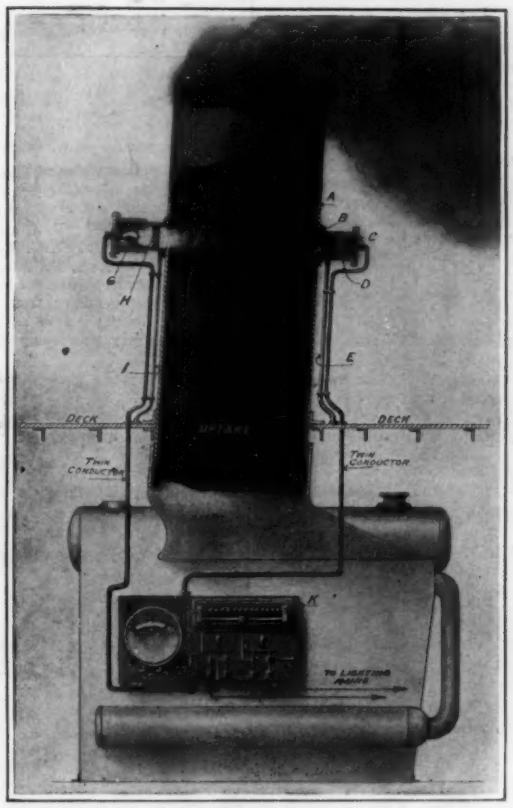
### An Electrical Eye that Tells Steamship Stokers What Is Passing Through the Funnels

SINCE a fireman's or stoker's main concern is the volume and density of the smoke passing out of the funnels of a steamer, it follows that the ideal location for the boiler room would be one in full view of the funnels. But steamers are not and can not be built that way, hence the men in the boiler room are without first-hand knowledge of the smoke issuing from the funnels. Especially in the case of war ships is it essential that the boiler room hands should be informed of the smoke conditions, particularly in connection with the formation of smoke clouds in actual battle or during maneuvers.

What appears to be a simple solution of the problem is presented in the accompanying illustration, which shows a system that has been installed on the U. S. steamer "Conyngham" for the purpose of indicating in the stokehold the density of the smoke in the uptake. This apparatus was the subject of a paper read by Rear-Admiral R. T. Hall of the United States Navy, before the twenty-fourth meeting of the Society of Naval Architects and Marine Engineers in New York City.

By studying the upper part of the drawing it will be noted that at each side of the funnel *A* there is fixed a cast-metal box, *F* and *B*. In the latter there is fixed an electric lamp *G*, and lens *H*. The light from the lamp is focussed by the lens and projected across the uptake, through the smoke and through a glass plate onto a non-conducting strip *D* wound with selenium wire. Through this wire there circulates a current derived from the lighting mains of the ship. Selenium, as is well known, has the peculiar property of changing its electrical resistance in accordance to the intensity of the light to which it is exposed, the resistance usually being low at high light intensities and higher at low intensities. Naturally, when the funnel is full of thick smoke the amount of light that can pass across the uptake and fall upon the selenium is small, and therefore the current decreases. This current passes through a galvanometer *L*, the scale of which is divided up into dark, medium, light and clear; and, as this galvanometer is mounted in some convenient part of the stokehold, the firemen can see at a glance the effect of their firing. By means of the potentiometer *K* the current in the galvanometer can be regulated to suit the readings desired.

But what of the soot that accumulates on the inner walls of the uptake? one immediately asks. And by way of an answer the designer of the system has provided for the removal of the soot accumulation at the points where the lamp and the selenium cell are affixed to the funnel, by introducing the small pockets *F* and *B*.




**A new role for the selenium cell: A stokehold indicator for the smoke passing up through a funnel**

Compressed air from the engine room is led to these pockets through the pipes *I* and *E*, which keep a constant current of fresh air passing from the boxes into the uptake. There is also a sheet of glass in front of the lens and another in front of the selenium cell, and both these can be readily withdrawn for cleaning should they become obscured.

### Experiments in Smoking Fresh Water Fish

EXPERIMENTS in smoking various species of fresh water fish begun at the Fairport, Mich., station of the United States Bureau of Fisheries about two years ago, have yielded interesting results. The bowfin, or grindle (*Amiatus calva*), which usually is regarded as practically worthless, has been found to yield a very superior product when properly smoked. All who have eaten samples have spoken of the excellent texture and flavor of the meat, and some have pronounced it the best of smoked fish. Further experiments are being made with a view to obtaining a product which will appeal to the trade in appearance and quality.

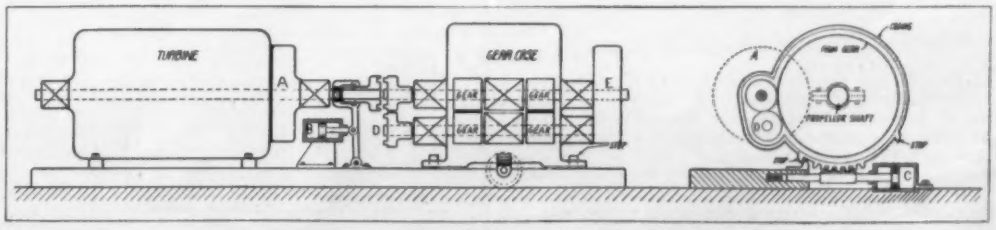
The bowfin is generally known through the Mississippi Basin as dogfish, and has been regarded as practically worthless. It is abundant in the Great Lakes and in sluggish waters from Minnesota and New York to Florida and Texas.

### Geared Drive Which Reverses with Full Power

IN view of the present discussion of "Electric" versus "Gear" drive for our proposed battle-cruisers, the following description of a reversing turbine gear drive invented and patented by Jesse W. Reno of New York, will interest the gentlemen who have taken part in this discussion. The drawing shows the "drive" in a somewhat diagrammatic manner. The object of the device is to do away with the extra reversing turbine required in the standard drive. This will reduce the cost, weight and space as compared with present marine installations. The present "backing" turbine, which revolves continuously at great speed with a certain amount of blade resistance, reduces somewhat the power output of the main turbine. For this and the reasons cited above, viz., cost, weight and space, the backing turbine is usually made small, and the backing power of a ship is only a portion (30 to 60 per cent) of the straight ahead power. In Mr. Reno's improvement the full power is available for backing. It will be seen that this is accomplished by making the gear case revolvable on the propeller shaft, thus bringing the extra pinion which is provided for reversing, in line with the turbine shaft, and then coupling the two shafts together. The operations for reversing the revolutions of the propeller, will probably consume more time than in the standard gear drive; but this loss of time will be more than made up by the increased backing efficiency of the propeller, due to the possibility of using the full power of the main turbine for both directions.

The operations for reversing the ship are as follows: Steam is shut off from the turbine; simultaneously, steam is let into the brake piston on shaft *E*, and the entire mechanism is brought to rest. Steam is then let into the clutch piston *B*, releasing the clutch. Following the shifting of the clutch, steam is turned into the cylinder *C*, which revolves the gear case through 25 degrees of arc bringing the shaft of the reversing pinion *D* in line with the turbine shaft; the jaw clutch is then slid into engagement. The brake is now released and steam is turned into the main turbine, which starts the propeller revolving with full power in the opposite direction. If for any reason the use of the brake is not desirable, the following method can be used for coupling the shafts: There is provided on the turbine shaft a coarse-bladed turbine disk of small power at *A*, the blades being reversed. Steam is shut off from the main turbine and the clutch is released. Steam is then turned into the turbine *A*, which revolves the main turbine rotor freely in the opposite direction. In the meantime the gear case has been turned until the reverse pinion is in line with the turbine shaft. The two shafts are then brought into synchronous revolution by tachimeter control, and the clutch is slid into engagement. Steam is now shut off from *A*, and turned into the main turbine, thus reversing the propeller. It will be understood that the clutch engagement will be made with the turbine shaft in free rotation without power, so that no injurious shock to the moving parts need be feared.

The reader will agree that in the plan suggested there are no radical departures from well-tried and accepted engineering practice. The turbine, "herring-bone" gears, shaft couplings and actuating mechanisms are standard and consequently can be relied upon




**Design for a geared drive which can reverse with full power**

## RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

### Pertaining to Apparel

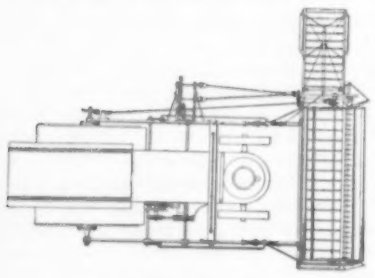
GARMENT.—L. STRAUSS, care of Knitwear Co., 65 W. Houston St., New York, N. Y. This invention provides a garment with a collar which may be converted at will into a head covering; provides a garment with a cape collar which may be converted into a military or standing collar; and provides a garment which will lie smoothly on the shoulders to be worn as a cape.

### Electrical Devices

DETECTOR FOR WIRELESS SYSTEMS.—M. BEREL and L. FUNKE, 1116 Hoe Ave., Bronx, N. Y. The specific object here is to provide a detector of the crystal type in which the active material, such as silicon, is hermetically sealed in a suitable container so as to be proof against all the ordinary disturbing influences, whereby the detector can be used almost indefinitely without requiring adjustment.

### Of Interest to Farmers

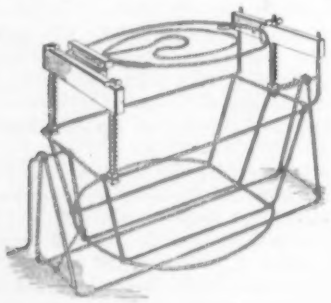
HARVESTING MACHINE.—J. M. VEATCH, Palco, Kan. This invention provides means for adjusting the header, and cutter bars carried thereby, to the desired position when harvesting wheat, and the like, of different heights and when passing over uneven ground and, to this end; the invention includes a frame pivotally con-



HARVESTING MACHINE

nected to some convenient part of the tractor and to the header, said frame supporting means for driving the several parts used in connection with said header and being vertically adjustable whereby the cutter bars and platform of the header may be raised and lowered.

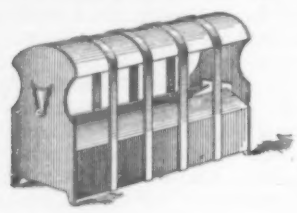
CHURN.—P. B. BELL, Brookhaven, Miss. This invention has particular reference to a rotary churn in which the receptacle is adapted to be detachably mounted. It provides a rotar



CHURN

carrier including a pivoted receptacle receiving member adjustably mounted so that receptacles of different sizes may be accommodated within the said carrier. It provides a churn simple in construction and easy to manufacture.

DRINKING TROUGH FOR CHICKENS.—R. G. TODD, 520 William St., Clearfield, Pa. The invention provides a trough so formed as to be sanitary in that the reservoir for the water is thoroughly protected against contamination by the chickens. A more specific object of the in-



DRINKING TROUGH FOR CHICKENS

vention is to provide a trough so constructed that should it be upset and thrown over on its side, it will nevertheless retain a quantity of water accessible to the chickens. The trough can be thoroughly and readily cleaned.

FRUIT DRIER.—L. B. SKINNER, Dunedin, Fla. The purpose in this case is to provide a drier in which in addition to subjecting the fruit to the action of air they shall also be subjected to the wiping action of a yielding absorbent diaphragm, which in addition to removing the moisture from the fruit controls the delivery of the air to the surface of the fruit.

PACKING DEVICE.—E. R. GILL, care of Alexander Moir, 161 Chambers St., New York, N. Y. The principal objects here are, to reduce breakage of eggs and bruising of fruit during transportation to a minimum and to prevent such breakage or bruising as may occur from spreading contamination to other provisions in the same crate or parcel. A further object is to provide packing units which may be easily adapted to retain delivery or transmission by mail.

MOTOR.—J. N. PARKER, Bedford, Va. The invention relates to motors for agricultural purposes and has for its object to provide a motor with which various farming implements may be used. It provides a motor which can be turned all the way around at the end of a row or corner, the rear traction wheel acting as a center.

GRAIN SHOCKER.—O. B. PETERSON, care of A. O. Stein, Box 14 R. F. D., No. 1, Twin Valley, Jackson, Minn. The purpose of the invention is the provision of an arrangement adapted to be connected to any suitable harvesting machine so that the bundles in the harvesting machine may be accumulated on a suitable platform and then discharged in a proper upright position.

### Of General Interest

KIESELGUHR FILLER AND METHOD OF PREPARING.—A. H. KRIEGER, 1106 Van Nuys Bldg., Los Angeles, Cal., The object here is to overcome former defects by providing a filler of non-aggregating substance by shaping it into a slab or block which can be easily handled without danger of disintegration. Consequently such a slab or block can be placed between the braces before the two walls are built up, the thickness of the slabs being substantially that of the distance between the walls of the structure.

STONE SETTING.—F. P. LITTLEJOHN, care of The Littlejohns, 12 Imperial Arcade, Sydney, Australia. The object of the improvement is to provide an inexpensive and efficient method of setting stones on material, in which setting the stone and the setting are located on opposite sides or surfaces of the material, with the setting acting through the material to hold the stone in position.

FOOD AND PROCESS OF PREPARING THE SAME.—M. QUINANE, 1023 Washington Ave., Hoboken, N. J. The invention relates to the preparation of foods and has particular reference to the composition and method of preparing foods that are intended for future consumption and which may be kept in good condition for an indefinite length of time and served with facility.

REEL.—H. J. LEACH, Mount Carmel, Ill. The inventor provides a reel more especially designed for use of telephone and other companies, to permit linemen to conveniently place a coil of covered duplex wire in position on the reel and to permit of readily carrying the reel and the coil of wire about from one place to another for paying out the wire as required without danger of the wire becoming entangled.

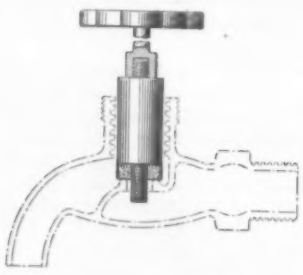
BINDER.—H. S. BRENAN, 42 Prince St., St. John, N. B., Canada. The invention relates particularly to binders for separate sheets, as for instance, sheet music, and has for an object the provision of an improved construction and arrangement whereby either a double sheet or single sheet may be readily inserted or removed at any time.

### Hardware and Tools

DENTAL PLIERS.—J. B. MCALLISTER, Milo, Cal. The invention provides an arrangement for holding a cord or ligature while the pliers are being operated so that a knot arranged in the ligature may be drawn between adjacent teeth for causing a separation thereof. It provides a retaining means for the ligature which may clamp the ligature at any point and hold the same under proper tension.

DEVICE FOR USE IN CROCHETING AND OTHER WORK.—F. E. KINNEY, Jericho, Vt. The general object of the improvement is the provision of a device of the indicated class adapted to be properly sustained on the hand of the user, and having means attachable to the finger of the hand for manipulating the thread and tensioning the same.

VALVE SEAT GRINDER.—A. C. WALTZ, 37 Court St., South, Port Arthur, Ontario, Canada. The invention has particular reference to means for grinding and dressing the valve seat of water faucets and the like. It provides a tool or set of tools to be carried by a plumber or other artisan, or to be kept on hand in his shop for



VALVE SEAT GRINDER

the purpose of repairing leaky faucets by regrinding or dressing the valve seats, the tool is adapted to be operated either by hand or by motor and comprises a shank adapted to carry either or both of a plurality of cutters such as a steel milling cutter for roughing off, and a carborundum finishing cutter.

SOLDERING DEVICE.—R. C. BRADLEY, 709 Louisiana St., Houston, Tex. This invention provides an automatic soldering device which is primarily designed to seal cans, like the oil cans of the export type. It provides a device which will operate quickly to distribute the sold er evenly, thereby rendering the soldering operation less expensive.

LOCKING MECHANISM.—R. C. BRADLEY, 709 Louisiana St., Houston, Tex. The invention is designed particularly to lock and unlock liquid dispensing apparatus. It provides a lock capable of being operated by any of a number of keys of a similar type but of slightly different construction one from the other, with means carried by the lock for rendering any of said keys inoperative at will.

### Heating and Lighting

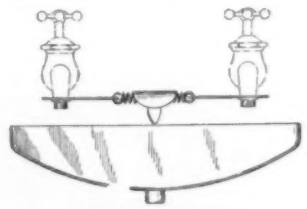
ILLUMINATING DEVICE FOR LIFE LINES.—J. C. CERICOLA, 226 High St., Brooklyn, N. Y. The device is especially adapted for illuminating a projectile used on life lines so as to disclose whether or not the life line passes over a stranded ship when the projectile has been fired from a gun. The invention provides a device which will almost instantly become ignited upon the pull of the projectile against the same.

### Household Utilities

COMBINED FRESH AIR PLATE AND SEWER GAS CHECK.—F. N. ROWAN, care of Flynn & Rowan, 11 E. 167th St., New York, N. Y. In carrying out the invention use is made of a perforated head having a connection with the fresh air inlet pipe and a normally open valve mounted to close the head on pressure developing within the pipe, and to swing inward to more or less full open position on a suction within the pipe to allow fresh air to pass in corresponding volume through the head into the air inlet pipe.

RINSING AND DRAINING DEVICE FOR CLOTHES.—R. GOSMAN, Amagansett, L. I., N. Y. This improvement relates to clothes washing machines, and has particular reference to that type of washers in which the rinsing and draining of the clothes are accomplished. It so constructs the frame and body of the machine that it will stand erect or substantially erect with the clothes and suds retained in or adjacent one end of the body.

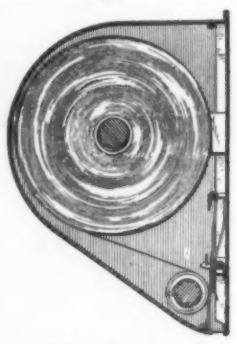
FAUCET WATER MIXER.—A. ROSENTHAL, care of Santher, 26 E. 106th St., New York, N. Y. Among the principal objects which the present invention has in view are: The provision of a



FAUCET WATER MIXER

device for mixing water of different temperatures preliminary to delivering the tempered water for use. The engraving shows a front elevation of a mixer as in service.

TOILET PAPER HOLDER.—J. T. SHERIDAN, 4115 Maryland Ave., St. Louis, Mo. This invention relates to holders for toilet paper in rolls, and provides a holder from which a desired amount of the paper may be withdrawn at will, which positively prevents waste of the paper,

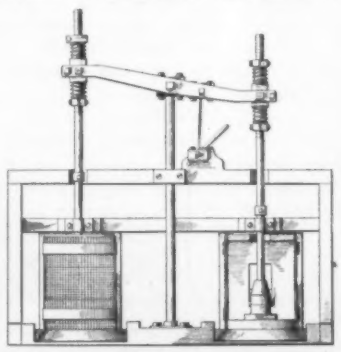


TOILET PAPER HOLDER

which allows instant substitution of a new role of paper for an exhausted one, which provides an efficient lock to prevent unauthorized access to the paper roll, and which provides means whereby there is no likelihood of the paper being withdrawn back into the holder whereby none could be drawn therefrom.

### Machines and Mechanical Devices

ADJUSTABLE CUSHIONING MEANS FOR LEVER ACTUATED MECHANISM.—R. R. KUSS, 251 W. Spring Ave., Boise, Idaho. The

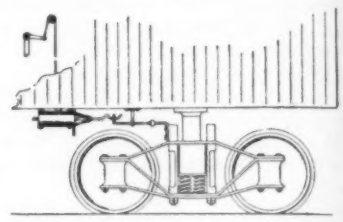


ADJUSTABLE CUSHIONING MEANS FOR LEVER ACTUATED MECHANISM

cushioning means is shown in connection with a stamp mill composed of two stamp units, wherein the stamps of the unit are connected to the ends of a lever which is a walking beam which is adapted to be oscillated by any suitable means to reciprocate the stamps, and wherein the stamps are connected to the beam in such manner that they may yield with respect to the beam to prevent injury to the parts during the operation of the mill.

### Railways and Their Accessories

AUTOMATIC TRUCK CONTROLLED TRAIN STOP.—L. E. GLENN, Box 222, Greensboro, N. C. The device actuates on conductors emergency valve handle only. It automatically pulls the conductor's emergency valve in case of any unnatural movement of the truck caused by derailments, split switches, spreading of rails, broken wheels or trouble to truck or track. This safety appliance has been applied to a six-wheel



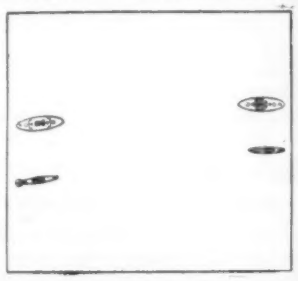
AUTOMATIC TRUCK CONTROLLED TRAIN STOP

truck passenger car and thoroughly tested, and the operation was entirely satisfactory. While the machine automatically pulls the emergency valve it does not interfere with the conductor pulling it at any time. The invention is mechanically operated. No electricity. No connection to train line pressure.

### Pertaining to Recreation

TUMBLING DOLL.—J. GOWDEY, 1612 N. Clarion St., Philadelphia, Pa. This doll simulates a human being in appearance and is constructed with a hollow elongated body containing a spherical weight or ball, whereby, when the doll is placed on a duly inclined surface, it will make a tumbling or end-over-end movement by the effect of gravity on the ball.

GAME APPARATUS.—Patent No. 1,213,562. This invention provides an interesting naval war game, in which several war vessels of different types are represented, the war vessels of each type having surfaces marked thereon indicating

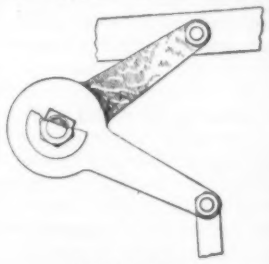


GAME APPARATUS

vulnerable parts which the opposing players may endeavor to strike with members representing projectiles and torpedoes which are fired from the turret and other gun and torpedo positions on the vessel.

### Pertaining to Vehicles

SHOCK ABSORBER.—J. Y. STEWART, Van Houten, N. M. The inventor provides a shock absorber which may be adjusted relatively to the chassis and the running parts of an automobile. With his construction the shock absorber will not function until the chassis is moved relatively to the running parts beyond normal running



SHOCK ABSORBER

position, the shock absorber then operating to limit the movement of the chassis relatively to the running parts, the resistance of the shock absorber increasing as the chassis moves farther fromnormal running position.

VEHICLE TIRE.—F. FITZHARRIS, Box 724, Texarkana, Tex. The improvement pertains to vehicle tires of the non-pneumatic type, and the objects are to improve and to simplify the construction of tires so as to be reliable and efficient in use, and so designed as to provide the maximum resiliency without the use of compressed air.

SPRINGING OF VEHICLES.—A. J. ADAMS, The Cottage, Heywood, near Westbury, Wilts, England. This invention has reference to the springing of vehicles of various sorts, of the kind wherein the vehicle frame is attached to the axle by means of levers, the ends of which act on horizontally arranged springs, and the invention has special reference to the springing of automobiles.

VEHICLE SIGNAL.—M. H. NEWMAN, 1703 Atlantic Ave., Atlantic City, N. J. This invention provides a signal which is simple in construction and enables the driver of the vehicle to throw a pertinent sign into position in case the driver intends to stop or turn out to the right

(*Concluded on page 268*)

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## Concreting a Railroad

*(Concluded from page 258)*

top of this machine is surmounted by a huge funnel. The concrete mixture is elevated in tiny buckets on an endless chain to the top and dumped into the funnel. The fence post molds are set in a revolving holder below. As each mold comes underneath the funnel enough of the mixture to fill it is admitted. Another mold then comes underneath the funnel and is filled in the same manner, while the completed posts are being removed from the machine and laid away in their molds to harden.

Thanks to the Burlington railroad the grounds surrounding the country depots have their cement curbing the same as a city street. In the past this curbing usually was of wood or stone. The concrete curbing is now manufactured in sections at the concrete plants and then supplied to the different stations all ready to be installed. The sections are fastened together with steel dowel pins. To install them it is only necessary to dig a trench, set the sections in it, and then bank the earth up again, a simple process in comparison with the usual mode of laying concrete curbing, which requires a gang of concrete workers to each job.

In many ways the entire program of concrete manufacture might be known as an effort to fireproof the right of way, since most of these articles largely take the place of wood. One does not have to look very far back into the past to recount tragedies that occurred when a bridge burned out. Wooden bridges have already been discarded on a good share of the roads, and the substitution of concrete with a ballasted roadbed has removed one of the terrors of railroading. Likewise the use of concrete fence posts represents the elimination of another fire risk.

It is not yet possible to say how satisfactory all of the work will prove in the test of years. Generally speaking it costs little more to turn out a piece of work in concrete than wood, and, if present tests can be relied upon as indicative of the future, the life of the concrete structures will be very much longer. Experiments are being made from time to time in the utilization of concrete for other work along the right of way and time only will tell the ultimate extent to which it may be used.

## The Current Supplement

ALTHOUGH there is nothing more acommon in nature than the physical ills of man there exists no definition of the fundamental concepts of disease. A valuable paper in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2149, for March 10th, 1917, on *What is Disease*, discusses this problem in a very comprehensive manner. *The Use of Meteoric Iron of Primitive People* describes various specimens of this rare form of metal. It is accompanied by several sketches and speaks of the various implements made from it before modern civilization was known. *Amateur Astronomical Photography* describes and illustrates an easily constructed camera for a telescope by means of which much interesting work may be done, and shows it application and a specimen photograph. *New Railway Lines Projected in Russia* discusses proposals for the development of transportation and manufactures in that country, and the means by which they may be carried out. *Tunneling Under a River* describes some of the difficulties and incidents encountered in the subway work being carried out in New York. *The Ancient Capitals of Lanka* describes some wonderful ruins in Ceylon that antedate the Christian era. It is illustrated by a number of attractive pictures. *On the Correct Adjustment of Chemical Weights* describes methods for securing accuracy in comparisons of substances under scientific investigation. *The Earth's Magnetism* in a most interesting paper on the discoveries of Halley's Expedition in 1698, and the investigations under the auspices of the Carnegie Institution of Washington in the present century. It is accompanied by several illustrations. Other articles include *Reduction of Nitrous Oxide by Contact Action of Metals and Metallic Oxides*, and *How Waste Paper is Used in Paper Mills.*

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**Three children pinned beneath the wreckage!**

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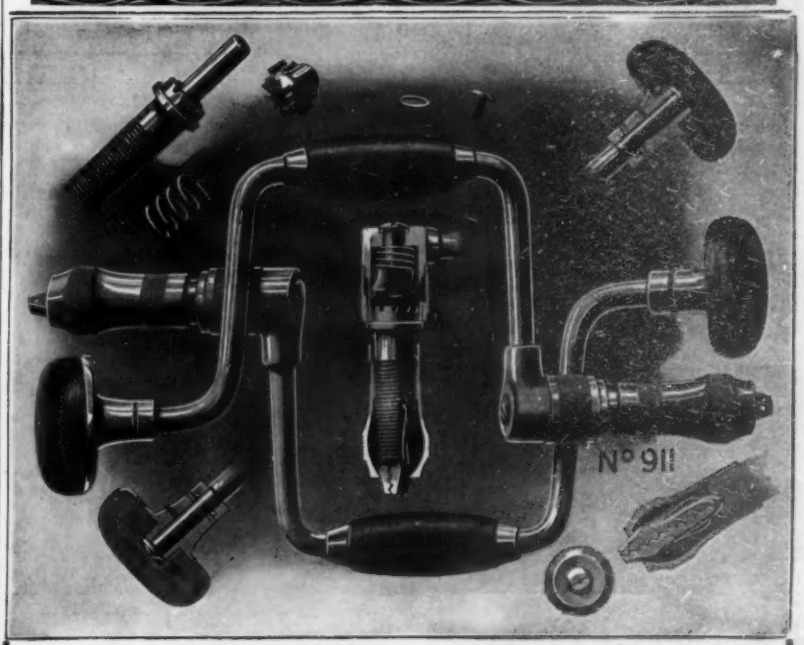


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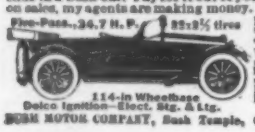


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THE TOOL OF MANY USES

## The War, the Reindeer, and the Aurochs

(*Concluded from page 259*)

In short, in the north of Sweden, as in all countries when pastoral and agricultural industries are in contact there is a constant and bitter conflict between herdsmen and farmers, and the question has become a Gordian knot for the authorities.

"In the interest of colonization, it is necessary to reduce the numbers of the herds in the wooded zone, but until now this radical measure has been deferred for fear of causing discontent among a part of the population."

This is why the government is delighted to meet the demands of the German provisioners. In Norbotten, where the conflict has been most bitter, the royal ordinance prescribes that the contingent of 20,000 deer whose exportation is authorized must be comprised entirely of the "forest reindeer," which are those belonging to the "foresters." Since it is these which commit most of the depredations in the clearings the farmers are highly pleased. On the other hand the Lapps are enchanted at selling their herds for prices hitherto undreamed, as high as 1.4 francs per kilogram (28 cents). Complementary ordinances provide that the herds thus depleted may not be restored to their former size, as also that 'sedentary' proprietors (in Norbotten) must have disposed of their herds within the next ten years. "Thus, within a near future these *cerridae* will be expelled from the whole forest zone of Swedish Lapland, *i. e.*, from the largest part of the territory; only the mountain zone will remain open to them. This restriction will very certainly entail a considerable diminution in the numbers of the Lapps."

The writer closes his article with a few paragraphs concerning the aurochs, saying that only three small groups of this survival of quarternary fauna exist in Europe, two in Russia and one on the northern slope of the Caucasus, and he considers the former doomed. "The principal herd of these bisons in Lithuania has its home in the forest . . . between Bielostock and Brest-Litovsk, where the fighting has been particularly lively; the second, much smaller, is in Volhynie . . . where the war has raged with equal violence. These animals have survived hitherto only by grace of the safeguards with which they were surrounded by their noble proprietors. . . . In short the aurochs were treated like the pheasants in the woods near Paris."

## Feeding the Nation

(*Concluded from page 262*)

is an inevitable loss in the silos owing to fermentation and even to decay of some of the beets.

A factory capable of handling a thousand tons of beets a day represents a plant outlay of quite a million dollars. For nine months of the year this establishment is idle, and all because beets can only be supplied to it for a maximum period of a hundred days annually. Even so, the beet sugar production of 1916—measured by prices charged the housewife—will represent something like $147,000,000. Manifestly, there would be a great economic gain, which would no doubt bring down the price of sugar, if these expensive factories could be operated throughout the entire year, with wider areas contributing beets to each refinery. That is to say, instead of having rail transportation limited to a hundred miles, imagine the gain if the beets could be delivered from distances of four hundred miles at the same freight rate, and in such shape that when received at the refinery they could be held without depreciation and utilized at any time, even months after their arrival. This is exactly what the new drying process makes possible.

Fresh beets are prepared for the diffusion cells of the refinery by being cut into small pieces or slices which are technically known as cossettes. In this form, the pieces of beets can be permeated by the hot water and the sucrose content withdrawn. The new system consists of drying plants located at convenient points anywhere within a zone of four hundred miles from the refinery and adjacent to lines of rail transportation. At these dehydrating establishments the beets received from the nearby farmers are cut into cossettes and promptly desiccated—one short ton of beets weighing but 500 pounds when so dried, and the bulk being reduced proportionately. Samples of beet cossettes treated in this manner at a Bound Brook, New Jersey, factory have remained unimpaired in storage, just as raw sugar might be packed, for a period of more than two years. Measured by dry substance polarization, the percentage loss of cossettes stored in burlap feed bags was only 1.66 after 730 days, and curiously enough there was a decrease of nearly fifty per cent of the original moisture. What is even stranger, because of the relatively low temperatures employed, enzymic action is not halted by the dehydrating, and sugar production continues for a while, thus yielding an increase of from five to eight per cent over that of fresh cossettes at the time of their diffusion by the general practice. This increased sucrose production was discovered years ago by the Department of Agriculture, and was considered a puzzling phenomenon. Dehydrated cossettes now actually promote this conversion of normally unformed sugars in the beets, and this gain alone is enough to reduce enormously the cost of running a refinery or to neutralize the expense of drying and transporting the dehydrated cossettes.

Farmers now hundreds of miles away from a refinery can grow beets and be sure of a certain and profitable market; and the beets when dehydrated can be transported in bulk, in box cars, without fear of deterioration. When received at the factory they can be stored where the air can reach them freely and will remain fit for the diffusion process for many months. Not only that, but because of their relatively intensified sugar content, less water will be required to accomplish thorough extraction of the sucrose, the diffusion liquor will be richer, and to just this measure less heat will be needed to effect the subsequent operations.

## A Curious Use for Aniline Dyes

DR. ERWIN BAUMANN, a Koenigsberg (Prussia) surgeon, is using large quantities of aniline dyeing materials for curative purposes and has successfully treated over 400 patients with this novel medicament. As a germ killer and arrester of noxious growths these materials are found to be far superior to any antiseptic substances so far known; they are quickly distributed, do not coagulate albumen and, in the quantities used, are absolutely non-poisonous. They can thus be used in a very compact form, and their prompt destruction of all bacteria rapidly stops suppuration, heals wounded tissues, and causes a lowering of temperature.

Dr. Baumann has used these materials in very many cases with unusual success; at first he used methylene blue and, subsequently, methyl violet, which in most cases, he found gave the best results. For burns, cuts, scratches, whitlows, abscesses, injuries to the skin of the head, and in many other cases the surface of the wound was painted with a 4 per cent dye solution and (unless very dirty), the wound was closed up at once. If easily accessible the wound was treated with the dye in powder form whilst, in the case of deep wounds, a solution of the dye was worked up into a paste with glycerine which, with the addition of a little alcohol, was then introduced into the wound, by the aid of a small rod. If the wound is already deepened by cavities antiseptic gauze is saturated with the dye solution and then carefully introduced into the cavity. Fistulous passages were treated by squirting the dye into them with a syringe. After one or two treatments all formation of matter was found to cease, all unpleasant odors disappeared, and the wounds dried up.

In the case of osseous suppurations, such for instance as in osteomyolitis, the period of convalescence was greatly shortened. Also in ventrical ulcers, appendicitis, abscesses and the like anilines were found to be of great value; suppuration rapi...

## RECENTLY PATENTED INVENTIONS

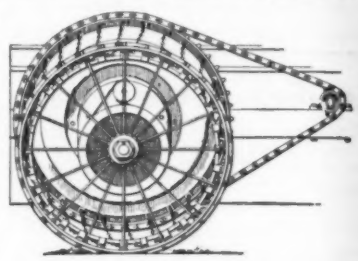
(*Concluded from page 266*)

or left, thus giving a signal to a following vehicle of the intentions of the driver.

ELECTRIC HORN CONTROL.—B. F. STEPHENSON, 827 5th St., Edmonton, Alberta, Can. This improvement refers to signaling devices and particularly to a controlling device for electric horns, and provides an arrangement adapted to be connected to the steering post of an automobile in such a manner that the operating parts will be adjacent the hand at all times.

VEHICLE SPRING.—L. E. MORROW, 819 Franklin St., Sandusky, Ohio. The invention provides a spring with equalizing levers, each connected to an axle at one side of the vehicle, and by a spring is connected to the body at the opposite side, so that when an end of the axle is raised at one side of the vehicle by contact of a wheel mounted on the axle with an obstruction, it tends through certain means to draw the body down at the other side, which will be equalized by the spring at the first mentioned side, which connects the body with a similar lever. The springs at one side of the vehicle body act on the springs at the other side to prevent tilting of the body.

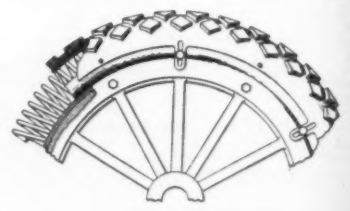
TRACTOR DRIVE WHEEL.—A. R. TEACH, Lakefield, Minn. This invention provides a wheel wherein the tractor wheel proper is connected to an eccentrically mounted driving ring by a



TRACTOR DRIVE WHEEL

series of flexible members, the ring being mounted at such a point that the tractive power is exerted on the wheel at the point where it will act to the best advantage to drive the tractor wheel.

TIRE.—J. J. TROTTER, 205 Kent St., Brooklyn, N. Y. This invention relates particularly to a non-puncturable tire which gives substantially the same effect as the ordinary pneumatic tire now commonly is use. It provides a resilient tire which does not depend upon air for giving the



TIRE

cushioning effect, and one whose spring and associated parts including rubber cushioning blocks give the same appearance and effect as the ordinary pneumatic tire now in use. The resiliency is produced by a plurality of independent members acting together.

SPROCKET WHEEL.—J. DOMERHAUIZEN, 423 E. 77th St., New York, N. Y. This invention improves the construction of a sprocket wheel adapted for general utility and has particular reference to sprocket wheels for controlling the movement of a moving picture film. In a film sproket wheel great disadvantage has been experienced in the replacement of worn sprockets and the invention provides a means whereby the mechanism may be simplified both in construction and manipulation, and whereby a worn sprocket may be replaced by a new one with a minimum expenditure of time and money.

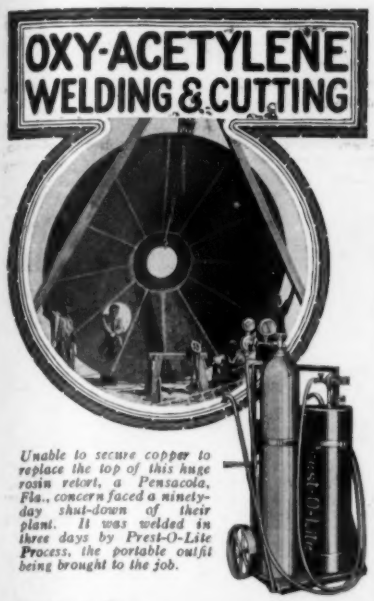
AUXILIARY SEAT FOR AUTOMOBILES.—W. H. DOUGLAS, 51st St. and Broadway, New York, N. Y. This invention provides an auxiliary seat arranged to permit convenient folding, when not in use, under the front seat, and to allow quick and safe extending for use without interfering with the comfort of the persons on the rear seat of the automobile and without interfering with the lowering of the windshield on the back of the front seat.

TIRE PROTECTOR.—A. W. NEFF, Bellevue Farm, Powell, Ohio. The improvement provides a protector arranged to prolong the life of the tire, to prevent punctures and blowouts, to insure the desired cushioning effect with comparatively little air pressure in the tire, to reduce the tendency to skid to a minimum, and to allow the use of a broad tread on a tire of small diameter.

### Designs

DESIGN FOR A SHOWER PLATE FOR GAS AND ELECTRIC FIXTURES.—S. SHAPIRO, 15 Laight St., New York, N. Y. The top plan view shows this design of circular form. From the center spoke-like extensions radiate to rings near the outer edge of the circle. Between these are added features that enrich the ornamental appearance of both the plan and edge presentations.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of patentee, title of the invention, and date of this paper.

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ceased and the cavities granulated and closed. Even on using as much as one gram daily, no harmful effect was observed. The injection was rapidly absorbed by the tissues, and subsequently left the body through the kidneys upon which no prejudicial effect of any kind was exerted. Methyl violet gave excellent results in cases of suppurations in the pleural cavity, whilst methylene blue was found to be especially valuable for irrigating the bladder and destroying all bacteriæ and germs.

## Motion Pictures in Colors and Relief

(*Concluded from page 263*)

frames per second. The frames are made in the order shown, and the relationship between color filters and images is indicated by the lines. Opposite each image made through the red filter a black stripe or mark appears in the perforated margin of the film, to serve as a guide at all times; for with the position of the red image thus indicated, the laboratory staff, the operator of the projector, or anyone else can immediately locate the red or any other color image, since the order of sequence is always the same. The black stripe or mark is made in the camera by allowing a ray of light to come through a small tube mounted on the lens board, at the moment when the red image is being recorded.

The positives are printed in the usual manner, and although the finished film is in black-and-white and does not materially differ from ordinary film, it nevertheless carries latent color values. Some strips of positive film indicate the color separation to a greater degree than others, depending on the subject, so that adjacent images may often be of somewhat different densities.

At this point the question naturally is asked: By what magic is this monochrome, lifeless film made to give up its latent colors?

The process of reproducing the original is simple when once explained. To begin with, a color-wheel composed of colors similar to those used in taking the photographs, is geared to the projector in the manner shown in two of the accompanying illustrations. For certain reasons, however, the selection and arrangement of the colors differ slightly in the projector and camera. By again referring to the diagram it will be noted that the projector makes use of a six-segment color-screen shutter or color-wheel, three segments being in graded shades of red and three in graded shades of blue. It will be noted, furthermore, that each image on the film remains in position long enough to be projected on the screen with three shades of the red or blue color, as the case may be. The red and orange images are projected with light passed through the three red segments, while the blue and blue-green images are projected with light passed through the three blue segments. The speed of projection is 24 images or frames per second, and it is the well-known persistency-of-vision phenomenon that causes full color pictures to appear on the screen, instead of a rapid succession of red-orange and blue-green pictures. In other words, at no time are three-color pictures actually projected on the screen; but the rapidity with which the alternate red-orange and blue-green images are thrown on the screen causes them to appear as full-color pictures to the human eye.

The attachment for converting the standard projector into a color-picture projector is a most ingenious device. By referring to the illustration of this device it will be noted that it consists of a large gear, *A*, which is driven by a pinion attached on the shutter shaft of the projector, while *B* and *C* are small gears forming part of the gear transmission. At *D* is a cone member which, in conjunction with the hub of the color-wheel *G*, forms a simple cone clutch. The purpose of this member is to alter the relative setting of the color segments at will, in order to synchronize them with the film images. This synchronizing can be accomplished while the machine is in operation, the knob *D* being loosened for the purpose and again tightened when image and segments


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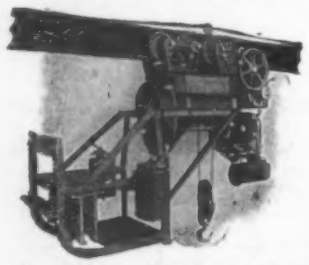

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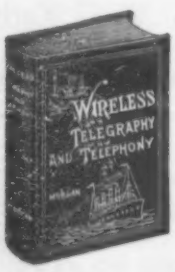


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This is a book the wireless experimenter cannot afford to be without. It enables one to design and construct their own apparatus. This book will also prove of value to the laymen.

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are in proper step. The color-wheel can be thrown out of the beam of light from the lantern at will by means of lever *E*, so that the machine can be instantly converted into a black-and-white projector; in fact, during the projection of color pictures the operator can throw out the color-wheel at any moment, thus changing the pictures to plain black-and-white. The transmission system, meanwhile, is still engaged with the pinion on the shutter shaft, so that the color-wheel remains in step with the film images. Since the speed of projection is an important factor, the attachment is provided with a speed indicator, *F*, whereby the operator can adjust the machine not only for color projection, but also for the 16-pictures-per-second speed of black-and-white projection. The speed, in the case of motor-driven projectors, is readily altered by means of a rheostat with which the modern machines are provided.

The projected pictures by the new process are truly a revelation, not alone in the delicacy of detail and the remarkable pastel shading, but in the remarkable degrees of depth or relief found in these motion pictures. In the exhibitions already referred to fast motion was portrayed, such as a high-speed hydroplane, yet no signs of fringe were noticeable. Then again, the colors were found to be remarkably lifelike, in contradistinction to the rather exaggerated color values found in some of the earlier color films. Neutral shades, such as rich browns and grays, were faithfully reproduced in all the scenes in which they appeared, and this, above all, may be considered the crucial test of any system of color photography.

## A Week's Review of the War, March 1st, 1917

(*Concluded from page 260*)

usual first-class condition, as well known to those who have traveled in that country. But two years of war with the consequent wear and tear, and with little or no opportunity to get new rolling stock or to repair the old are beginning to tell their story. The roads are constantly loaded down with trains carrying troops and supplies to the exclusion of civilians or of the necessary tranportations of food and supplies for urban populations. Now that the canals and rivers are frozen, these arteries of traffic are closed and many towns and villages are reduced to the pinch of hunger for lack of transportation facilities. The invasion of Belgium gave a good deal of rolling stock to Germany that has been utilized on the roads as far east as Russia and through Austria to the southwest even into Rumania. Austria, though, is feeling the shortage and the difficulties incident to it; this is accentuated by the use of many miles of single track railways, extending over long distances and requiring the services of many women who have taken the places of men in both Germany and Austria since this war began. There are constant and repeated complaints in both countries of the railway service; and switching accidents, collisions and derailments are common occurrences.

Recent incidents on the Macedonia front indicate a strong offensive movement as soon as spring weather will permit. The ultimate object will be of course to cut off Turkey by cutting the railroad line from Vienna to Constantinople. If a sufficient force can be obtained to justify the movements, there will be two routes undertaken—one from the western end from Monastir via Prilep to Uskub and Nish, the other from the eastern end of the Allied lines along the valley of the Struma River via Seres and Kustendil to Sofia. The advance up the valley of the Vardar River will assist both the other columns. The Germans and Bulgarian forces are strongly fortified in trench works, as on the western front, and the Allied forces, in order to make their intended advances, will have no easy task. Now that the Greek Army has been transferred to the Peloponnesus an attack from the rear need no longer be feared and the Allies are free to advance whenever weather conditions will allow. It is said that the French commander of the Allies has determined not to make a forward movement until he has at his command 500,000 men. At present he has possibly 400,000 men at various points and these are being constantly reinforced, especially by Italian troops arriving at Salonica or by way of Valona through Albania to connect up with the French and Serbians at Koritza and Leskovitza. The occupation of these two places finally extends the Allied line across the Balkan Peninsula from the Adriatic at Valona to Salonica on the Ægean Sea, thus effectually cutting off Greece from all communications with the Central Allies.

Stirring events may be expected soon in this region and strong backing by Germany will be needed if the Central Powers are to hold their own in the Balkans.

A most important movement now in full operation is that of the British force on the Tigris under General Maude; the capture of Kut-el-Amara and the rapid pursuit of the fleeing Turkish troops to a point at present about thirty miles from Kut and 80 miles from Bagdad, presage the early fall of the last city. It will be remembered that Kut was the position on the Tigris to which the ill-fated expedition of the British troops under General Townsend retreated after its defeat at Ctesiphon, 25 miles from Bagdad in December, 1915. General Townsend was forced to surrender at Kut in April, 1916, after a siege of four months or more. Relief expeditions were on their way to him up the Tigris but they could not reach him before his supplies failed and his command was threatened with starvation. Later, in December, 1916, an expedition of 120,000 Anglo-Indian troops began an advance along the south bank of the Tigris; these troops reached and crossed the Shatt-el-Hai a canal connecting, at Kut, the Tigris with the Euphrates to the South. Swinging the left wing of the army over the Tigris to the north and east, Kut and the fortified lines of Sanna-i-Yat were taken in the rear and the hasty abandonment of both by the Turks became necessary. Their columns are now apparently in full flight to Bagdad with the loss of many prisoners and of valuable military stores. Bagdad is of course the objective point, though the protection of the oil fields in Perisa, near the Persian Gulf, has also been one of the reasons for the expedition. Once Bagdad is in British possession, the scheme of Germany for a vast Oriental influence or empire to be connected with Germany through Turkey by the railroads from Berlin to Bagdad will have failed. If the railroad through Asia Minor to Bagdad has been finished, it would be an important factor in military movements in Mesopotamia. But there are undoubtedly gaps in places of 100 miles or more, thus rendering difficult any sustained defence of the city, and placing in a dangerous position troops retreating from that place up the Tigris.

The Russians in Persia are probably now again at Kermanshah; once the British troops are in Bagdad communication with these forces will be easy. The armies of Grand Duke Nicholas have many strong positions in Asia Minor and a force is no doubt ready now to reach the Tigris at Mosul, coming from Bitlis on Lake Van. The defeat of General Townsend last year permitted the movement of Turkish troops directly and indirectly to many other threatened points in Europe as well as in Asia Minor. To-day, the face of military conditions has changed entirely in the Ottoman Empire; the army threatening the Suez Canal has been driven back and the rebellion in Arabia has permitted the establishment of the kingdom of Hedjaz, strongly supported by the French and British. Now with a British army on the borders of Palestine, another operating in Mesopotamia and the Russians in motion in Armenia, no troops for use in Europe can be spared by Turkey.

Everything points to the establishment in the near future of a Russian military line from the Caucasus Mountains to the Mediterranean at the bay of Alexandretta and to a subsequent advance on Constantinople from the east.


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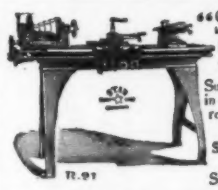

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## SCIENTIFIC AMERICAN

## March 17 —— April 21

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## Industrial Issues

In these issues, the SCIENTIFIC AMERICAN is but complying with its well recognized obligation; viz., to announce the latest developments in scientific, mechanical and industrial progress for the benefit of manufacturers and business men.

The first of these special Industrial Numbers appeared on February 17th, with an exhaustive discussion of the research facilities in this country. It presented practical examples of what can be done when the man of science and the man of production work hand in hand.

The second Industrial Number will appear on March 17th, and will continue the subject of research in the industries. In this issue there will be articles written by the men who have actually conducted such research work and who are publishing for the first time their marvelous discoveries. Additional articles on Industrial Mobilization against War, and what the Government is doing for our Industries, will lend unusual interest to this number.

**Advertising Forms for March 17th issue Close March 8th**

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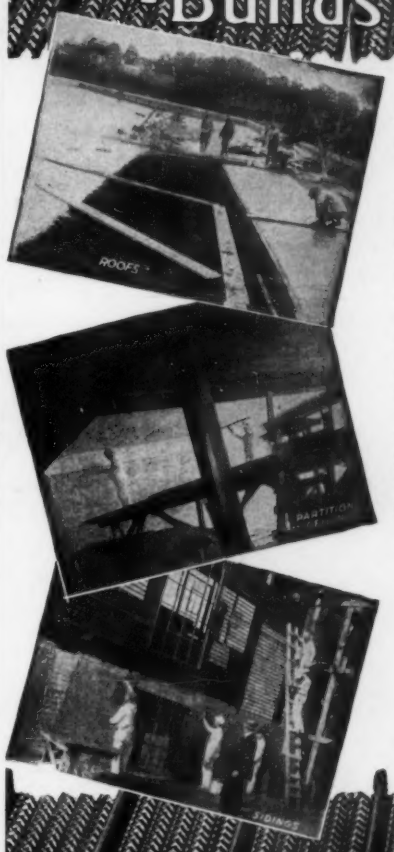


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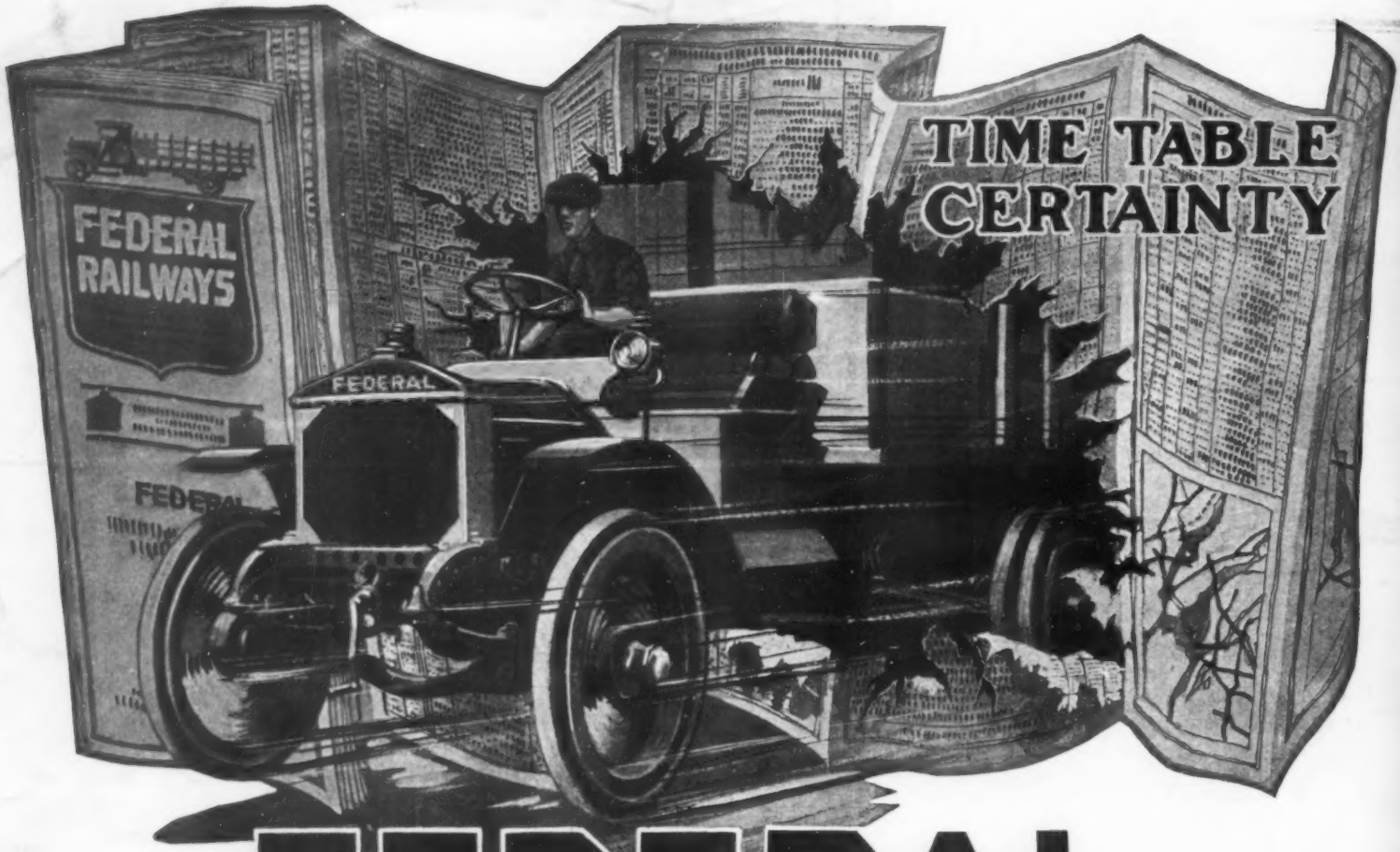


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| " | Lve. | 7.45 | 8.00 | 8.15 | 8.30 |
| Plant | Arr. | 8.00 | 8.15 | 8.30 | 8.45 |
| " | Lve. | 8.15 | 8.30 | 8.45 | 9.00 |
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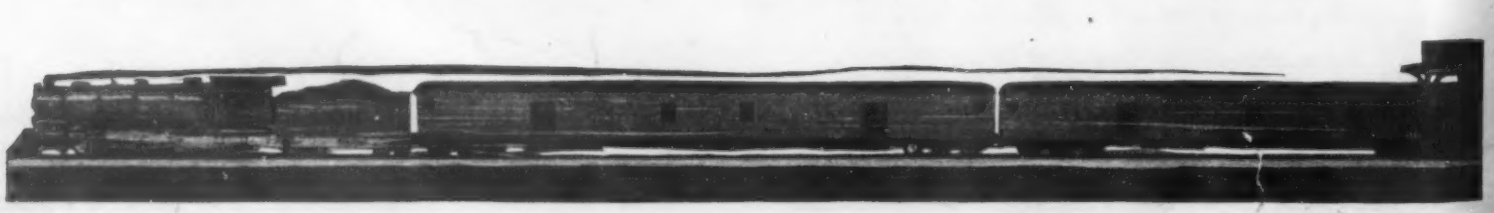

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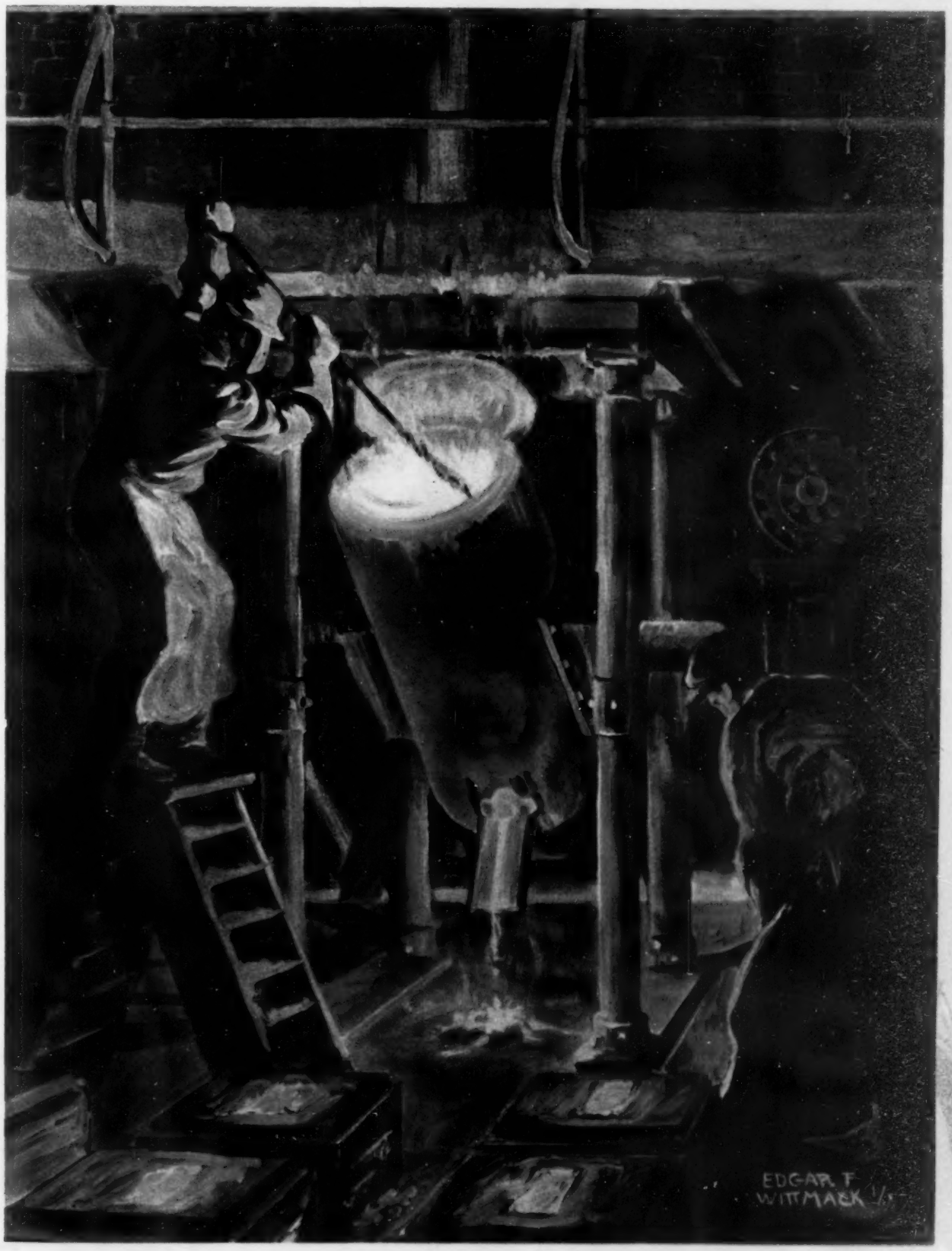


CLEANING OUT THE SMALL-CASTING FURNACE—[See page 279]

March 17, 1917

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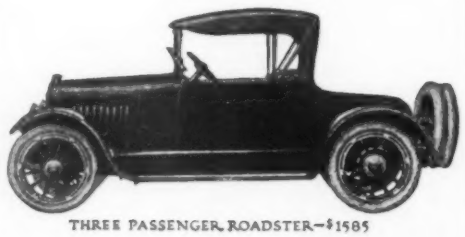

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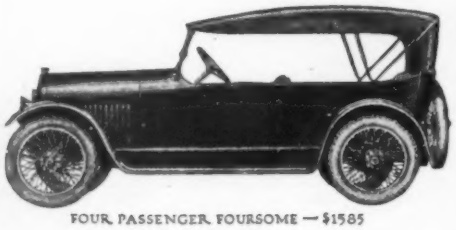

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